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THE PLEISTOCENE FAUNA OF TWO BLUE NILE SITES

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FOREWORD

By A. J. Arkell

Archaeological Adviser to the Sudan Government

In 1924 Mr. W. R. G. Bond, Governor of the (then) Fung Province of the Anglo-Egyptian Sudan (since absorbed into the Blue Nile Province, in which Singa is at present a district headquarters), found in the river bed near his house at Singa a fossilized human skull, which was presented to the British Museum (Natural History), and eventually described by Sir Arthur Smith Woodward in *Antiquity* in 1938. A few years later a member of the staff of the Sudan Antiquities Service was sent to Singa to collect more of the fossil bones already reported, and, if possible, stone artifacts. He returned without any artifacts but with some fossils including the important buffalo skull now described by Miss D. M. A. Bate. As soon as my war duties allowed, I paid a visit to Singa and also to Abu Hugar, about 20 miles upstream of Singa, where Bond had reported a fossiliferous limestone conglomerate in which he had found a round stone, possibly an artifact. At Singa repeated quarrying of the limestone deposit for road metal had removed most of the desired evidence, but at Abu Hugar stone implements as well as fossil bones were found *in situ*. There is little doubt that the fossiliferous strata at Singa and Abu Hugar are contemporary.

The fossil bones and stone artifacts from these two sites are the subject of this memoir; and the Keeper of the Department of Geology took advantage of the presence in England of Dr. L. H. Wells, of the Witwatersrand University, to persuade him to re-examine the fossil human skull. Dr. Wells' report is included here. Following the discovery of a negroid skull at Khartoum (described by Dr. D. E. Derry *in* Arkell, 1949), the Singa–Abu Hugar area is the second in the Anglo-Egyptian Sudan at which a fossil human skull, animal bones, and artifacts of human origin have been found in association, and it is one of the first of such sites in Africa to be made the subject of a comprehensive study.

Miss Bate's paper is more than an examination of the fauna of these two sites. It is an important study of Fossil African Buffaloes, which will speak for itself. The archaeological significance of the conclusions of the three experts may be summarized here. Out of all the Stone Age periods in Africa it is most difficult to form a clear picture of the Middle Stone Age, and it is to this period that Mr. Lacaille with every reason assigns the artifacts. He considers that typologically they are nearest to an advanced Levalloisian (or advanced faceted-platform technique) culture from South Rhodesia, and in his opinion are even more advanced.

Dr. Wells, who confirms that the human skull is of pre-Bushman type, considers that it is related to, but naturally in view of the geographical distance separating them, not exactly comparable with, any individual "Bushmanoid" skull from

South Africa. He is inclined to think that the frontal characters of the Singa skull indicate an early stage in the specialization of the Bushman type. Dr. Wells draws attention to the apparent association of the Levalloisian technique with all known skulls of pre-Bushman stock, perhaps in East Africa as well as in South Africa and the Sudan, and also to the possibility that, as Leakey has suggested for Kenya, in north-east Africa the Levalloisian culture developed independently of the Aurignacian (or rather Capsian). He is not, however, prepared to choose between the two possible implications of the recognition of a pre-Bushman type in the Nile valley; but if the Singa skull is an early stage in the specialization of the Bushman type, it seems likely that this type was not native to South Africa, but entered from the north, a solution which would account for the existence of Bushman-like rock paintings in the Libyan Desert and in Spain.

Miss Bate points out that the fauna is characterized by extinct forms, and draws attention to the probability that there was in Africa a big faunal change during the latter part of the Pleistocene, similar to that long recognized in Europe and already recorded for East Africa between the Upper Kamasian and the Gamblian pluvials. If future research should prove that the pluvial periods recognized in Kenya extended at any rate to part of the Anglo-Egyptian Sudan, it might well be established one day that the dark clay of the Gezira plain, which overlies the fossiliferous limestone conglomerate at Singa and Abu Hugar, was laid down during the Gamblian pluvial, and that the Singa skull and its associated artifacts date from before the maximum of that pluvial. Such a conclusion does not appear to be inconsistent with Dr. Wells' view of the skull.

Postscript.—The death of Miss D. M. A. Bate on January 13*th*, 1951, *after she had corrected the galley proofs of this paper, has deprived prehistorians in general, and those of the Nile valley in particular, of a helper whose skill and wide knowledge were invaluable, for they were unique. She had other collections in hand, and by her study of them, had she lived, more light would have been thrown on past climatic changes in North Africa, on the relations between the fauna of Africa and Asia, and on the origin of some domestic animals. Until someone arises to do Miss Bate the honour of following in her steps, the advance of prehistoric archaeology in North Africa and elsewhere must inevitably slow down.*

THE MAMMALS FROM SINGA AND ABU HUGAR

By Dorothea M. A. Bate

Introduction

Knowledge of the earlier mammalian faunas of the Anglo-Egyptian Sudan has been meagre until now, and the few published records may be briefly noticed here. In 1876 Vacek described a skull of a fossil buffalo which was found associated with remains of a large hippopotamus, and was said to have come from a fluviatile deposit at no great distance from Khartoum. The author considered that it represented an animal belonging to the *antiquus* group, with horns very different from those of *Syncerus caffer*, and growing directly outwards and backwards. He suggested that it belonged to a distinct species, but refrained from supplying a name; there can be little doubt that this was a skull of the extinct buffalo to be described below.

Little more than ten years later Lydekker (1887) described some mammal remains from Wadi Halfa which he suggested were of early Pleistocene or uppermost Pliocene (Villafranchian) age. The most important specimen is an upper cheek tooth of an *Equus* belonging to an earlier type than those of the present day. This tooth has sometimes been quoted as showing the presence of *E. sivalensis* in Africa, but Lydekker himself acknowledged that this single example was insufficient for specific determination. The study of the fossil Equidae of Africa is at present in rather a bewildering condition, but it is hoped that Professor Arambourg may soon give us a comprehensive view of the whole subject. Some remains of *Cervus* were mentioned in connection with Lydekker's Wadi Halfa collection, but I can find no further details or description. Remains of *Cervus* have also been recorded in a Villafranchian fauna from Gau by Parona (1918, p. 828). With other Asiatic genera such as *Sivachoerus*, *Cervus* seems to have reached Africa at this time, but so far as is known at present failed to establish itself. The Recent North African deer are probably a later introduction.

Many years after this Andrews (1912) described an imperfect tooth of an elephant which had been found at a depth of 60–68 feet below the low level of the Nile not far from Khartoum. It is not certain to what extinct species it should be referred, and the geological age of the deposit is equally uncertain. The associated fauna included remains of hippopotamus, a small giraffe, an antelope (?*Tragelaphus*), and a siluroid fish.

In 1927 a small collection of mammal remains was secured by Mr. A. J. Arkell during the digging of a well in his garden at Kosti on the White Nile, about 180 miles south of Khartoum. Among these were the canine of a carnivore, and the third lower molar of a large extinct pig which Dr. A. T. Hopwood (1929) described under the name of *Hylochoerus grabhami*, but which Professor Arambourg has since suggested (1944 and 1947) should be included in the extinct genus *Omochoerus*.

More recently, as a result of Mr. A. J. Arkell's excavation of an early occupation site (Mesolithic) in Khartoum itself (1949) a large collection of animal remains was available for study. The specimens were much broken, but showed the presence of a fauna very different from that occurring in this area at the present day. The only animal that could be determined specifically proved to be an extinct species, *Thryonomys arkelli*, with affiliations with a group of Reed Rats, members of which have been found fossil in the central and western Sahara (Bate, 1947 and 1949).

The collection now to be described marks an important advance in our knowledge of the early zoological history of the country, and is indeed of more than local importance, since the study of one of the specimens has revealed facts of considerable significance for African mammalian palaeontology. The remains were sent to the British Museum (Natural History) for study in 1947 by Mr. A. J. Arkell, then Commissioner for Archaeology and Anthropology in the Sudan. They were obtained from the bed, or from the base of the bank, of the Blue Nile at two localities, Singa and Abu Hugar, south of Khartoum. Being well acquainted with the two sites Mr. Arkell considers that they are undoubtedly of the same geological age, and this is supported by the specimens themselves. An extinct species is known from each site, and remains of the extinct buffalo occur at both localities. This makes it possible to treat the remains from the two sites as comprising a single fauna.

Singa, 200 miles south of Khartoum, has long been known as the site from which Mr. W. R. G. Bond, in 1924, obtained the human skull which was later described and figured by Smith Woodward (1938). More recently Dr. L. H. Wells of the University of Witwatersrand has re-examined the skull with a view to comparing it with later finds from South Africa, and his results are given in one of the sections of this report. In a note following Smith Woodward's paper Mr. G. W. Grabham published a figure of a section of the site which certainly suggests a considerable age for the contained remains. Behind the foreshore, then the low river level of the Blue Nile, rose an almost vertical bank about 30 feet high and having a sequence of five distinct levels. Mr. Grabham suggested that the animal remains came from the older river deposits, level 4 in his table, with the reservation that they might be of even greater age.

The site of Abu Hugar is about 25 miles further up the river; here bones may still be found weathering out of the river bank, and it was under these conditions that the crocodile skull was obtained. An important factor at this site is the occurrence, associated with the animal remains, of implements of a crude human industry containing Levalloisian elements. These have been studied by Mr. A. D. Lacaille, and are described in another section of this report. Dr. J. D. Tothill (1946) has published an interesting study of the Gezira Clay Plain which lies south of Khartoum between the Blue and the White Nile. He deals chiefly with the fossil molluscan fauna and gives a provisional table of contemporary events based on this study. In this he correlates the Singa deposit with the Lower Levalloiso-Mousterian Levels C. & D. of Tabun Cave, Palestine. Further information about the formation and derivation of the Gezira Clay which is later than the mammal deposit is awaited from Mr. G. Andrew, Government Geologist, who is making a petrological study of its component elements.

All the specimens in the collection are more or less completely covered with a concretion of kankar. Most of the bones are broken, and too imperfect to admit of definite specific determination, except in the case of two skulls, one of a buffalo and the other of a porcupine, each of which represents an extinct form. With two exceptions the animal remains are those of mammals, mostly ungulates. The two exceptions are a river shell kindly examined by Dr. L. R. Cox, and a portion of a skull of a crocodile, which Dr. W. E. Swinton has kindly identified, his report being given below. Remains of ten species have been determined and are as follows:

1. Freshwater Snail.	
2. *Crocodilus niloticus* Laurenti	Nile Crocodile.
3. *Hystrix astasobae* sp. n.	Extinct Porcupine.
4. *Equus* sp.	Equine.
5. *Rhinoceros* sp. (large)	Rhinoceros.
6. *Hippopotamus* cf. *amphibius* Linnaeus	Hippopotamus.
7. ?Sivatherine	?Short-legged Giraffoid.
8. *Oryx* sp.	Oryx.
9. ?Antilopine or ?Caprine	Extinct Antilopine.
10. *Gazella* sp.	Gazelle.
11. *Antilope* sp. (?Hippotragine)	Antelope (large).
12. *Antilope* sp. (about size of Grant's gazelle)	Antelope.
13. *Homoioceras singae* Bate	Extinct long-horned Buffalo.

Description of Species

Freshwater Snail

The single shell in the collection is in a very imperfect state of preservation. Dr. L. R. Cox writes: "It seems to be a sinistral freshwater snail."

Crocodilus niloticus Laurenti

Dr. W. E. Swinton writes of the single imperfect skull of a crocodile: "There is a considerable variation in the size and disposition of the teeth, in the shape of the premaxillary-maxillary suture, and in the size and shape of the openings of the premaxillary region of the Nile Crocodiles. I have gone through the Museum series of complete skulls and this fragment from Abu Hugar can be matched very closely. There is no question as to its being *Crocodilus niloticus* and it therefore throws little light on the precise age of these deposits. The fragment, the premaxilla with teeth, is fossilized and probably late Pleistocene."

C. niloticus is recorded as one of two species found in the Omo River beds (Arambourg, 1947).

*Hystrix astasobae** sp. n. (fig. 1)

Diagnosis.—A *Hystrix* about the size of *H. cristata*, with similar inflation of roof of skull. Rostrum short, shorter than in Recent species, and stout, anterior portion not narrowly constricted as in Recent species. Upper anterior border of premaxilla

* From Astasobas, an ancient name for the Blue Nile used by Strabo.

prominent, not deeply excavated as in Recent species. Nasals scarcely narrowing anteriorly, of similar width for almost their entire length with posterior border wide as in *H. africaeaustralis*. Nasals long, extending backwards to about the level of the glenoid fossa as in *H. cristata*. Upper posterior process of premaxilla narrow. Upper cheek teeth large compared with skull, as in *H. africaeaustralis*; posterior processes of palatines, and pterygoids stout, stouter than in Recent species. Palate reaching back to level with the anterior border of the last molar.

Fig. 1. Holotype skull of *Hystrix astasobae* sp. n.: (a) lateral view; (b) palatal view, natural size.

Holotype.—The anterior portion of a skull with two cheek teeth (fig. 1).

Locality and Horizon.—Abu Hugar, about 25 miles up river from Singa on the Blue Nile, at the base of the river bank. Pleistocene, associated with a human industry, remains of *Homoioceras singae*, and other mammals.

Description and Remarks.—The single imperfect skull from Abu Hugar probably represents the first extinct species of porcupine to be recorded from Africa. Probably through pressure during fossilization the skull is slightly distorted, chiefly in being somewhat compressed laterally, but it is still possible to observe many important characters, though precise measurements are not always obtainable, and the specimen itself is difficult to display adequately by means of drawings. When collected this skull, like that of *Homoioceras singae,* was almost completely covered with a concretion of kankar.

The Recent African porcupines can be divided into two groups (Ellerman, 1940). The *H. cristata* group, which is distributed over the northern and central part of the Continent, and the *H. africaeaustralis* group, which is found in suitable country in south and south-eastern Africa and at least as far north as Tanganyika territory. The skull of *H. astasobae* is more primitive in several respects than are skulls of Recent species, and it also shows some characters similar to those found in each of the two groups just mentioned. This is of course in keeping with its rather more generalized condition.

Great variation is seen in many of the bones of the skull in both the Recent groups, and perhaps one of the most constant characters is the comparative length of the nasals; in the *H. africaeaustralis* group these bones extend posteriorly only as far as in line with the anterior border of the orbit, whereas in the *H. cristata* group they reach as far back as in line with the posterior border of the orbit.

In *H. astasobae* the length of the nasals is about 74 mm., much as in *H. cristata,* but the short palate resembles the condition seen in *H. africaeaustralis.* Viewed dorsally the nasals in *H. astasobae* remain of almost constant width throughout their length, as in *H. cristata,* while the wide outline of their hinder borders resembles that seen in *H. africaeaustralis.*

One of the more noticeable of the primitive characters of the fossil skull is the short thick snout, which, viewed ventrally, does not exhibit that sudden contraction in the vicinity of the anterior palatine foramina which is so characteristic of Recent species. Another remarkable difference in this area is that, viewed longitudinally, the anterior portion of the upper border of the premaxilla in Recent species is deeply excavated above the incisor, while in *H. astasobae* the bone slopes gradually from its contact with the nasal. Viewed ventrally the skull of *H. astasobae* shows that the posterior processes of the palatines with the pterygoids are of unusual thickness.

Fossil Record.—Fragmentary remains of porcupines have been recorded from a great number of Pleistocene deposits in Africa, from Morocco, across north Africa and southwards almost to the Cape, but none seems to have been sufficiently well preserved for definite specific determination.

A tooth which may eventually be found to represent a near ally, if not a true *Hystrix,* was described and figured by Wells, Cooke & Malan a few years ago (1942). This specimen came from the Vlakkraal Thermal Springs, Orange Free State, and it has been suggested that the age is Upper Middle Stone Age, i.e. Upper Pleistocene.

Equus sp.

The collection includes three imperfect upper cheek teeth of an equine from Abu Hugar, but these are not sufficient to determine to which group they should be assigned, the zebras or the wild asses.

At the present day, zebras are found in the south-eastern corner of the Sudan in the Upper Nile and Equatoria Provinces. Wild asses occur in the opposite end of the country in the north-east, being recorded from the Red Sea Province, and from the vicinity of the Atbara River in the Provinces of Berber and Kassala (Brocklehurst, 1931).

The fossil record is meagre; the finding of equine remains at Wadi Halfa has already been referred to, and a single upper cheek tooth specifically unidentified was found in a Mesolithic site at Khartoum (Bate, 1949, p. 24).

Rhinoceros sp.

A rhinoceros is represented by an imperfect upper cheek tooth from Abu Hugar and the proximal portion of a right femur from Singa, neither of which show characters that are sufficient for definite specific identification. The femur, however, is of large size, with a maximum width of 23 cm. across the head and great trochanter, thus equalling the corresponding measurement of this bone in a Recent specimen of *R. simus* with which it has been compared. This suggests that it may be that of *R. simus*, the white rhinoceros, but the presence of a number of extinct species in the collection makes it unwise to affirm the occurrence of Recent species without ample material on which to base the identification.

Remains of rhinoceros were obtained from the Mesolithic Khartoum site (Bate, 1949) but are thought to have belonged to a smaller species than the above.

Hippopotamus cf. *amphibius* Linnaeus

Teeth and portions of limb bones of hippopotamus are more plentiful than those of any other species, and both adult and quite young individuals are represented. The specimens, which were found at both the Singa and Abu Hugar sites, are too fragmentary for a definite specific identification to be made.

?Sivatherine (fig. 2)

There are two imperfect limb bones from Abu Hugar which, although too fragmentary for definite identification, are of great interest since they suggest the presence of an extinct genus. These two bones are the distal portion of a right radius shown in fig. 2 and the distal end of a left humerus, which are certainly giraffoid in character. Compared with the corresponding bones in Recent and Pleistocene giraffes they show evident differences, the most important of which is the great width of the shaft as compared with the width of the distal articular end of the bone. The humerus of a large Recent giraffe and the specimen from Abu Hugar each have a maximum condylar width of 13 cm., while the width of the shaft a short distance above the condyles is 13·7 cm. in the Recent and 15·2 in the fossil specimen. The fossil radius at its distal articular end has a width of approximately 14 cm., while the width of the shaft is 10·5 cm. The corresponding measurements in that of a large Recent giraffe are 13·5 cm. and 8·7 cm.

While much more material is required before a definite identification can be made, the character of these two bones suggests that they belong to an extinct genus allied to *Sivatherium.* This would not be surprising, for remains of Sivatherines of various genera have already been discovered in north, east and south Africa. Some of the deposits from which these specimens come are not definitely dated, but it seems certain that they include localities of both early and Middle Pleistocene age.

Professor Arambourg has recently (1947 and 1948) written fully on the African Sivatherines, so it will suffice here to mention only the chief records and localities. Pomel (1892 and 1893) was the first to recognize the existence of the group in Africa when he described *Libytherium* from Algeria. This, or an allied form, has also been recorded from the early Pleistocene of the Wadi Natrun (Stromer, 1907). *Sivatherium olduvaiensis* Hopwood (1934) was first described from Olduvai, and has since been found in the southern Serengeti (Dietrich, 1942, pl. 19), and in the Omo River basin in Abyssinia (Arambourg, 1947, pl. 22). In South Africa the Vaal River gravels have yielded some teeth known as *Griquatherium cingulatum* Haughton (1922), and this species has since been discovered in the Makapan Valley, Transvaal (Cooke & Wells, 1947).

$\frac{1}{2}$

FIG. 2. Distal end of a right radius of a ?Sivatherine, $\times\frac{1}{2}$.

Oryx sp.

There is a piece of horn core from Abu Hugar, 16·5 cm. in length, which unmistakably represents an oryx, though unfortunately it is not sufficient to indicate to what species it should be assigned.

Two species of oryx can be counted among the Recent fauna of the Sudan, though neither is at present found in the vicinity of Singa. *Oryx beisa* is found to the north-east in the southern part of the Red Sea Province, and also in the east of Mongalla (now Equatoria) Province in the south. The white oryx, with curved horns, which has been placed in a separate genus, *Aegoryx,* occurs in the extreme north of Darfur and Kordofan, and perhaps in the Northern Province, its range extending westwards to Nigeria and the Gold Coast (Brocklehurst, 1931).

At the present day oryxes are generally found in more or less desert country, but this does not seem a natural habitat for large bovines, and has probably been adopted through pressure of necessity.

Antilopine or ?Caprine (fig. 3)

The collection includes a complete right horn core with a portion of the frontal and the eye socket preserved, from Abu Hugar. It was thought to represent one of the larger African antelopes, but comparison with the horn cores of representatives of almost every group of Recent African antelope, and with ibex, *Ammotragus*, and also various Asiatic forms has failed to reveal any of comparable shape. Specimens and figures of fossil species have likewise been consulted, with a similar result. There can, therefore, seemingly be little doubt that the horn core from Abu Hugar represents a species, if not a genus, hitherto undescribed. It seems unwise to give a name to this single specimen, but the drawings will serve to put it on record, and perhaps help in diagnosing future finds.

It will probably be found eventually that this horn core belonged to an antelope of large size, but the presence of a rounded keel on its anterior surface suggests the necessity for caution since a frontal keel seems to be unknown among Recent African antelopes, though it is not uncommonly present in some earlier Asiatic fossil forms (Teilhard & Trassaert, 1938 (?*Protoryx*); Pilgrim, 1937). The shape of this horn core might possibly suggest Caprine affinities, though this does not seem very likely.

It will be seen from fig. 3a that the horn core rises straight upwards directly above the orbit, and later curves gradually backwards. Viewed from in front (fig. 3c) it slopes outwards, and shows a slight tendency towards a spiral turn. The inner basal margin is fairly close to the frontal suture, showing that the bases of the two horns must have been close together. The maximum length of the horn core preserved is about 110 mm. measured in a straight line; the diameter from side to side at the base is 27 mm., and from front to back 46 mm. The specimen is narrow anteriorly with rounded keel, widening to the back; it is laterally compressed, with the inner surface slightly rounded, and the outer one practically flat. The entire surface is longitudinally grooved, in places to some depth.

Gazella sp.

Two fragmentary cheek teeth from Abu Hugar indicate the presence of a fairly small gazelle, perhaps about the size of *G. dorcas*.

Antilope sp.

A single horn core of a large antelope from Singa probably represents one of the Hippotragine group.

Antilope sp.

A right maxilla with three cheek teeth of an antelope is among the specimens from Abu Hugar. It is not possible to identify it specifically, but it resembles in size the corresponding portion of the skull in a Recent example of a female Grant's gazelle.

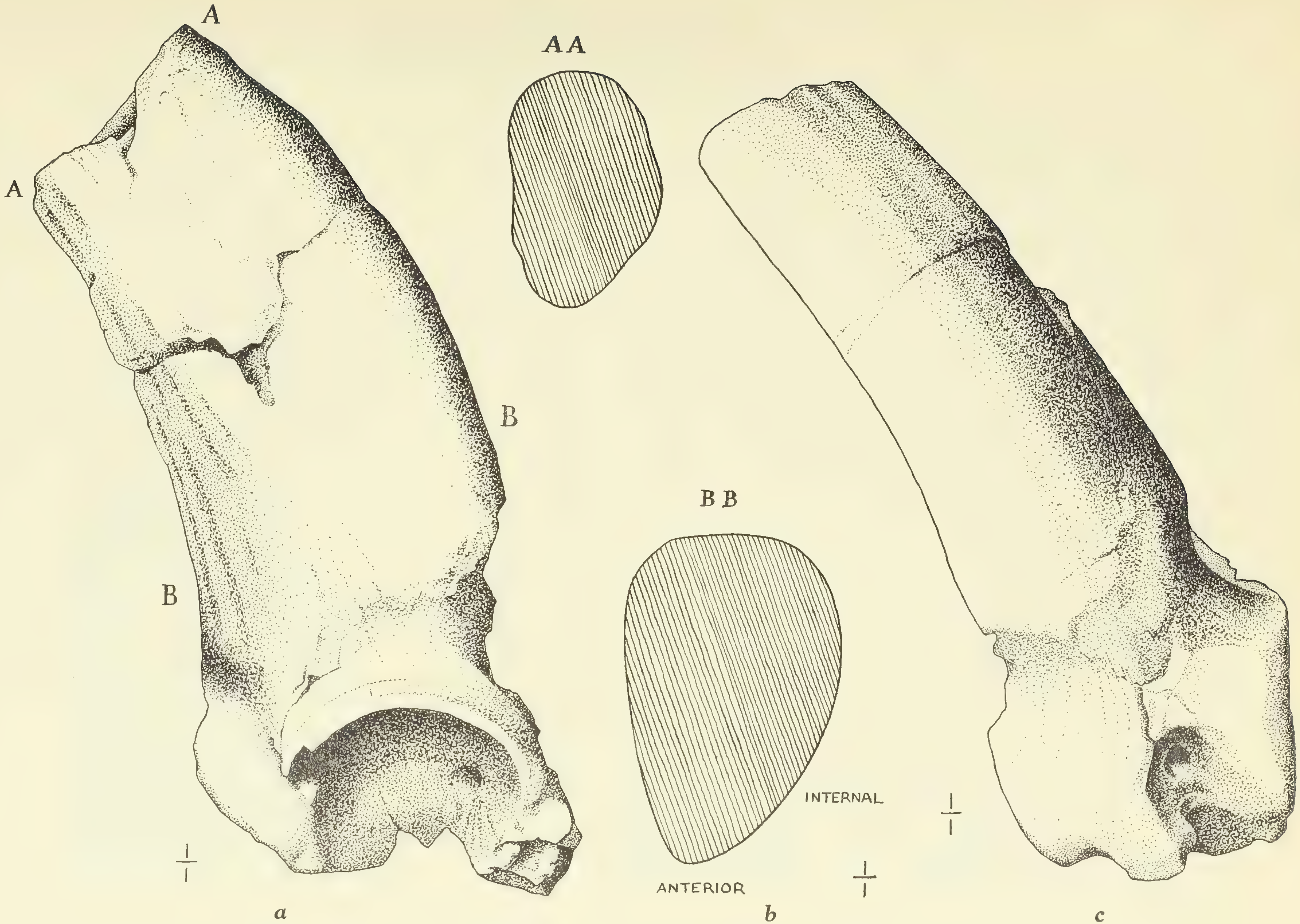

FIG. 3. Horn core of ?Antilopine: (a) lateral view; (b) sections; (c) anterior view, natural size.

Genus *HOMOIOCERAS* Bate

1949*a* Ann. Mag. Nat. Hist. (12) **2** : 397

The study of the buffalo remains from Singa has greatly helped to clarify the systematic position and the relationships of the long-horned fossil buffaloes of Africa. As will be shown below, they manifestly belong to the generic group Syncerina of the subfamily Bovinae (Pilgrim, 1939, p. 23), but as evidently represent a lineage distinct from the Recent African *Syncerus*, and one that is not ancestral to the Recent forms. I have, therefore, proposed (1949*a*) that the extinct long-horned African buffaloes be known as *Homoioceras*.

Diagnosis.—Extinct buffaloes belonging to the African Syncerina group. Generally of large size with very long and wide-spread horns, having a superficial resemblance to those of Recent *Bubalus*. Keels of horns obsolete except the hinder one. Males generally with horns nearly meeting on forehead, but without basal expansion; bony forehead rugose, but without raised prominences supporting the basal portions of the horns. Bases of horn cores project at right angles to the skull, and may be inclined slightly downwards. Face very, or moderately, short, rather or very broad; eye sockets not tubular. Only a short connection between the nasals and the nasal processes of the premaxillae. Palate short, and having no contact with the vomer; basi-occipital rising at an acute angle, or on a gradual slope; basi-sphenoid rising on a gentle slope. Basi-occipital a long isosceles triangle in shape.

Type Species.—*Homoioceras singae* Bate.

The species at present known and here included in the genus are:

Bubalus antiquus Duvernoy, 1851	North Africa
Homoioceras singae Bate, 1949*a*	Anglo-Egyptian Sudan
Bubalus nilssoni Lönnberg, 1933	East Africa
B. baini Seeley, 1891	South Africa

Homoioceras singae Bate (figs. 4, 6, 8a)

Diagnosis.—A *Homoioceras* slightly smaller than *H. antiquus* and *H. nilssoni*, but skull massive, with bones noticeably thick. Face short and broad, forehead slopes gently down to the nasals as in Recent *Syncerus brachyceros* from the Lake Chad area. Nasals vaulted, short and wide, with short area of contact with the posterior processes of the premaxillae. Supraorbital pits large, orbits slightly prominent. Horn cores arising only a short distance above the orbits, growing out horizontally with the dorsal surfaces in line with the top of the skull, no immediate downward inclination, frontal keels rudimentary, posterior keel present, section roughly elliptical. Occipital area of skull of great width, bases of para-occipital processes notably stout.

Basi-occipital bent upwards at an acute angle, with the basi-sphenoid continuing to rise gently. Basilar tubercles small, the bullae projecting well below the level of the basilar tubercles, and more inflated than in Recent *Syncerus*. The slightly concave palate is wide and short and has no contact with the vomer which arises a considerable distance beyond the basilar tubercles.

Holotype.—An almost complete skull from Singa, with the upper dentition and the bases of the horn cores, the left one preserved for a length of 105 mm.

Other Specimens.—Besides the skull from Singa a number of fragmentary specimens were obtained at Abu Hugar. One, part of a maxilla with cheek teeth, resembles very closely the corresponding part in the holotype. There are two pieces of horn core evidently from near the distal end of the core, the largest has a length of 46 cm., is deeply scored longitudinally and is strongly compressed laterally. The smaller piece has a circumference of 20 cm.

Distribution.—At present known from the Nile Valley, Anglo-Egyptian Sudan.

Description.—The most interesting specimen in the collection is the beautiful and unusually well-preserved skull of *H. singae* described above, for the discovery of which much credit is due to Sadik Eff. Nur of the Khartoum Museum. He recovered it from a government office at Singa where for more than ten years it had been performing the menial function of a door-stop. It is almost unbroken except for the loss of the greater part of the horn cores, and the anterior ends of the nasals and premaxillae. This completeness is partly due to its having become highly mineralized, and to its being protected by a thick coating of limy concretionary matter (kankar). This protective covering has since been almost entirely removed with great skill and care by Mr. A. E. Rixon.

There is a slight distortion of the skull due to pressure during fossilization, but fortunately this has had little effect on the general form of the specimen, except perhaps with regard to the position of the nasals which have been forced downwards. This makes it difficult to be quite sure of the original position of the outer borders of these bones, but it is almost certain that they were in contact with the premaxillae for a short distance, perhaps for 10 mm. Such a short junction of these bones is commonly found in some members of this genus and in *Syncerus*.

Comparing the skull of *H. singae* with that of a Recent buffalo from Sennar in the Sudan it is found that, although the general size is not very different, the massive proportions of the bones, and the great breadth and depth of the fossil skull are remarkable. Although they resemble each other in essential characters, one of the features in which the fossil displays a more primitive condition is the degree of difference between the upper and lower portions of the face. In the Recent species the facial portion of the skull is distinctly weak and attenuated, while the fossil displays stouter proportions.

This will perhaps be best appreciated by the measurements given in millimetres in the table below; the length of the skull of *H. singae* is approximate, owing to the absence of the anterior portion of the premaxillae.

Viewed in profile (fig. 8a) it is seen that in the skull of *H. singae* the forehead slopes gently down to the nasals, as it does in the Recent *S. brachyceros* from Lake Chad, but in the skull from Sennar, and still more so in typical skulls of *S. caffer*, the forehead

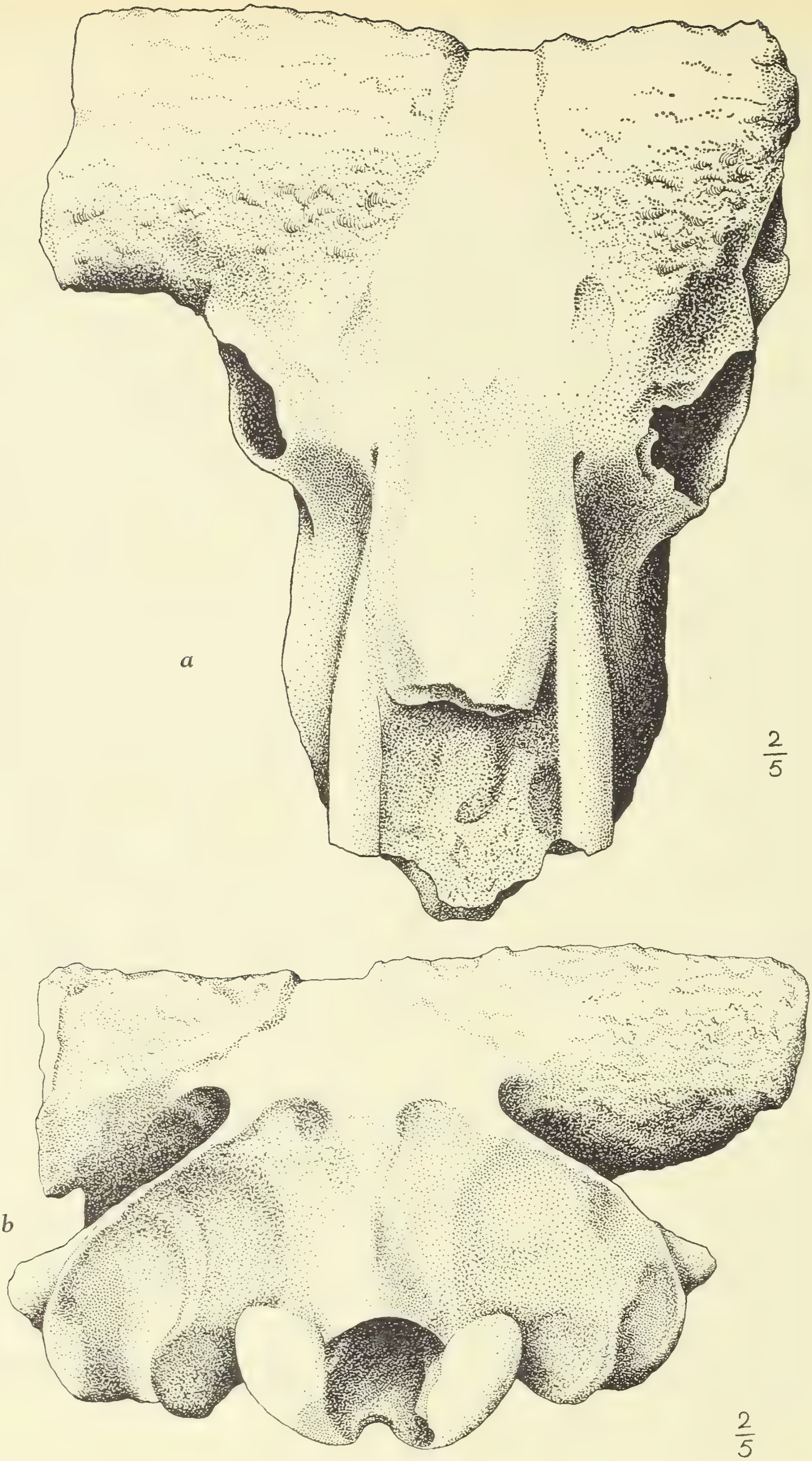

FIG. 4. *Homoioceras singae* Bate: (a) anterior; and (b) posterior views of skull (holotype), $\times\frac{2}{5}$.

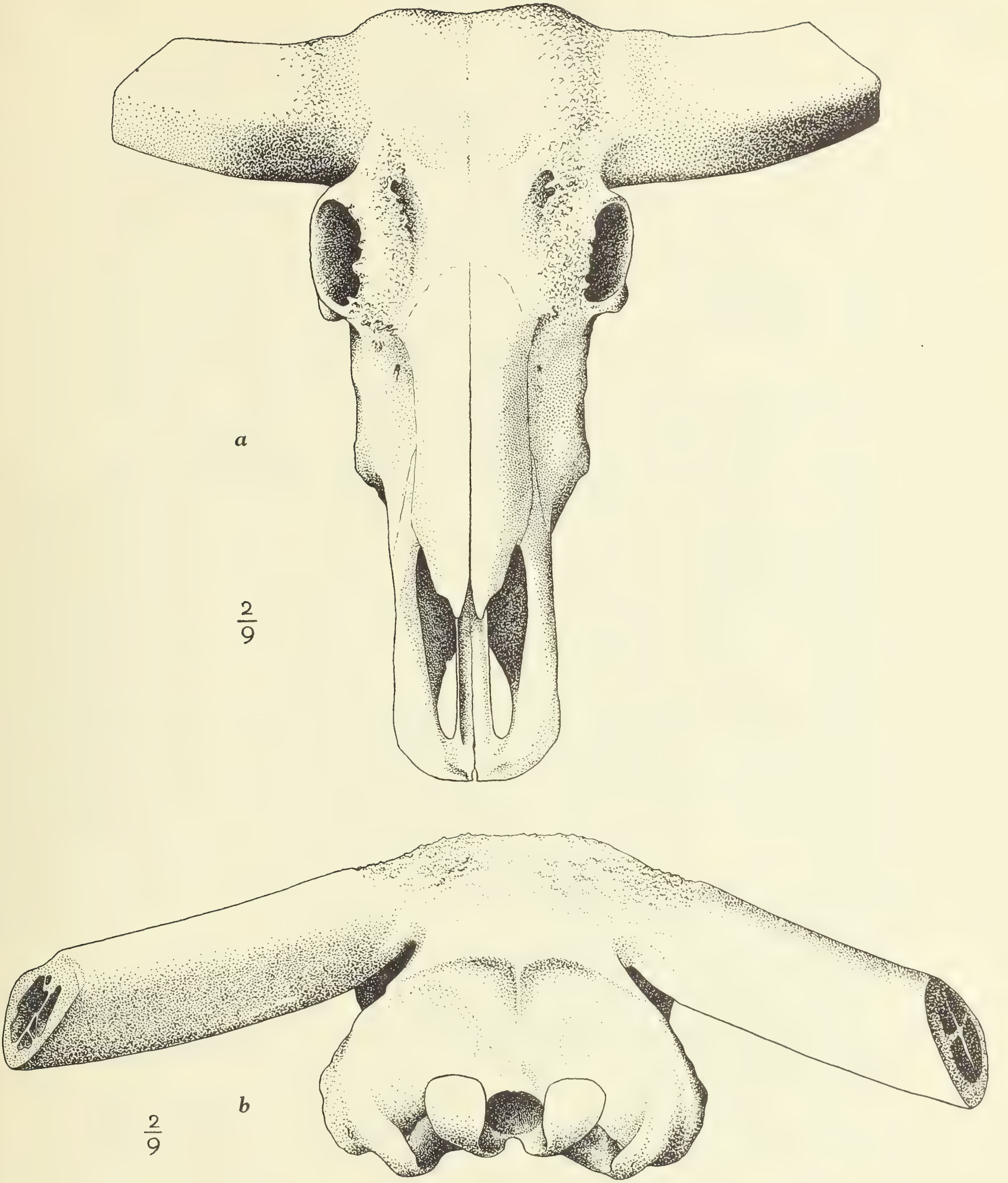

FIG. 5. *Bubalus bubalis* (Linn.). Recent skull from India: (a) anterior; and (b) posterior view, $\times \frac{2}{9}$.

	H. singae	*H. antiquus* (Pomel's specimen)	*H. nilssoni*	Recent *Syncerus* (Sennar)	Recent *Bubalus*
Length of skull from tips of premaxillae to the occipital condyles	510	600	650	512	610
Breadth of skull in front of orbits	170	225	204	150	173
		H. antiquus type			
Maximum width of occipital area	315	360	—	245	290
Maximum width of M²	34	38	29	27	32
Upper alveolar length	151	170	156	145	175

drops abruptly to the lower facial region, resulting in what might almost be described as an interorbital cavity.

There can be little doubt that the Singa skull is that of a bull, this being shown not only by the massiveness of the skull, but also by the fact that the forehead between the roots of the horn cores is covered with a slight bony rugosity except for a median area about 35–40 mm. in width. In the skulls of Recent species of *Syncerus* the rugosity of this region is for the attachment of the overlap of the dorsal part of the horn sheath, and no doubt a similar explanation is applicable to fossil skulls. In some skulls of *S. caffer*, which is a highly specialized form, the wide proximal expansions of the horn sheaths are further supported by bony prominences of the skull. In female skulls of Recent *S. caffer*, not only are the horns very much smaller than in the male and without the proximal expansion, but there is only a slight roughness on the forehead of the skull.

In the holotype skull of *H. singae* the anterior ends of the nasals are missing, but judging from other proportions it seems probable that they had a maximum length of about 195 mm. The corresponding measurement in a Recent Asiatic *Bubalus* skull is 265 mm. In *H. singae* the nasals are vaulted, and very broad, having a width of 52 mm. at their junction with the premaxillae; this measurement in the Recent *Syncerus* skull from Sennar is only 39 mm. The great thickness of the bones of the skull of *H. singae* can be easily appreciated from the view of the front of the face (fig. 4a) in which can be seen the upper borders of the premaxillae; these have a thickness of 24 mm., compared with 13 mm., in the Recent Sennar skull. In a Recent *Bubalus* skull, a larger animal than *H. singae*, this measurement is 19 mm.

It will be seen from fig. 4a and fig. 4b that the horn cores of *H. singae* emerge almost horizontally from the skull, and continue thus for at least 105 mm., the length preserved of the right core.

A somewhat similar condition can be observed in the holotype of *H. antiquus* from Setif although the section of the horn cores is very different from that seen in *H. singae* (fig. 8a, 8c).

From their section, size and direction it may be supposed that *H. singae* carried comparatively narrow but long horns, generally similar to those of the *H. antiquus* group, but, with the exception of the holotype mentioned above, in *H. antiquus* as shown in Pomel's and other figures, in *H. nilssoni*, and in *H. baini* the horns have a downward slope from their inception. In Recent *Bubalus* (figs. 5, 7, and 9a), except for the straight-horned variety (*B. macroceros*) from Assam, while the horns likewise make an immediate downward sweep, the direction is quite distinct from that in *Homoioceras*. Among Recent African buffaloes the horns are totally different from those of the *H. antiquus* group in which *H. singae* is included; many of the *S. nanus* group have uprising horns, while the large group culminating in *S. caffer* have horns broad at the base, sharply down-bent and then upturned at the narrow tip.

There is a strong superficial resemblance between the horns of Recent *Bubalus* and of the fossils *H. antiquus*, *H. singae*, *H. nilssoni* and *H. baini*, but this is certainly the result of parallel development, reached by independent lineages. Nevertheless it is no doubt this superficial likeness that has misled so many authorities to include the fossil African buffaloes in the Asiatic genus *Bubalus*.

Turning to the under-side of the skull of *H. singae* (fig. 6) we find some of the most important and primitive characters displayed. The shape of the basi-occipital is as in Recent *Syncerus* and in *H. antiquus*, that is to say that from the basilar tubercles the bone narrows rapidly to a point. The basi-occipital is bent upwards at an acute angle, and the basi-sphenoid then continues to rise at a gentle slope. A similar condition is seen in the specialized forms of Recent *Syncerus*, but in the more primitive *S. nanus*, with small upright horns, the basi-occipital, as well as the basi-sphenoid, rises at a gentle angle. It was thought at first that the angle of the basi-occipital might be governed by the weight of horn to be carried, but the angle is similar in the small-horned Recent *S. nanus* and in the holotype skull of *H. antiquus* with its unusually massive horns. It is probable that the angle is governed by the position in which the head is carried, while that again would be influenced by feeding habits. In Recent *Bubalus* the under-part of the skull is completely different (fig. 7). The basilar tubercles differ in size and construction, and the shape of the basi-occipital is almost quadrate, the bone being distally truncated; further it receives the proximal end of the vomer between the basilar tubercles, whereas in the Syncerina the vomer originates considerably in advance of this point. The basi-occipital in *Bubalus* rises at a gentle slope as far as the basilar tubercles, but in front of this the basi-sphenoid rises suddenly at a steep angle.

In *H. singae* the bullae are more inflated, and the hyoid pits are actually and comparatively larger than in Recent *Syncerus*.

In the *Homoioceras singae* group (fig. 6), as in Recent *Syncerus*, the vomer has no contact with the palatines, and the short palate hardly reaches behind the tooth row. The palate is broad and slightly concave, the width between the bases of M^3 is 90 mm. In Recent *Bubalus* again there is seen a great contrast (fig. 7), for the palate is narrow and prolonged considerably behind the tooth rows, and where the palatine processes and the pterygoids meet is an expanded area. The vomer is fused with, and partly enclosed by, the hinder edges of the palatines, and at this point of contact the vomer becomes considerably thickened. Pilgrim (1939: 255) has pointed out that this is the condition already seen in *Proamphibos* and *Hemibos* (Middle and Upper Pliocene), the earliest known members of the *Bubalus* lineage.

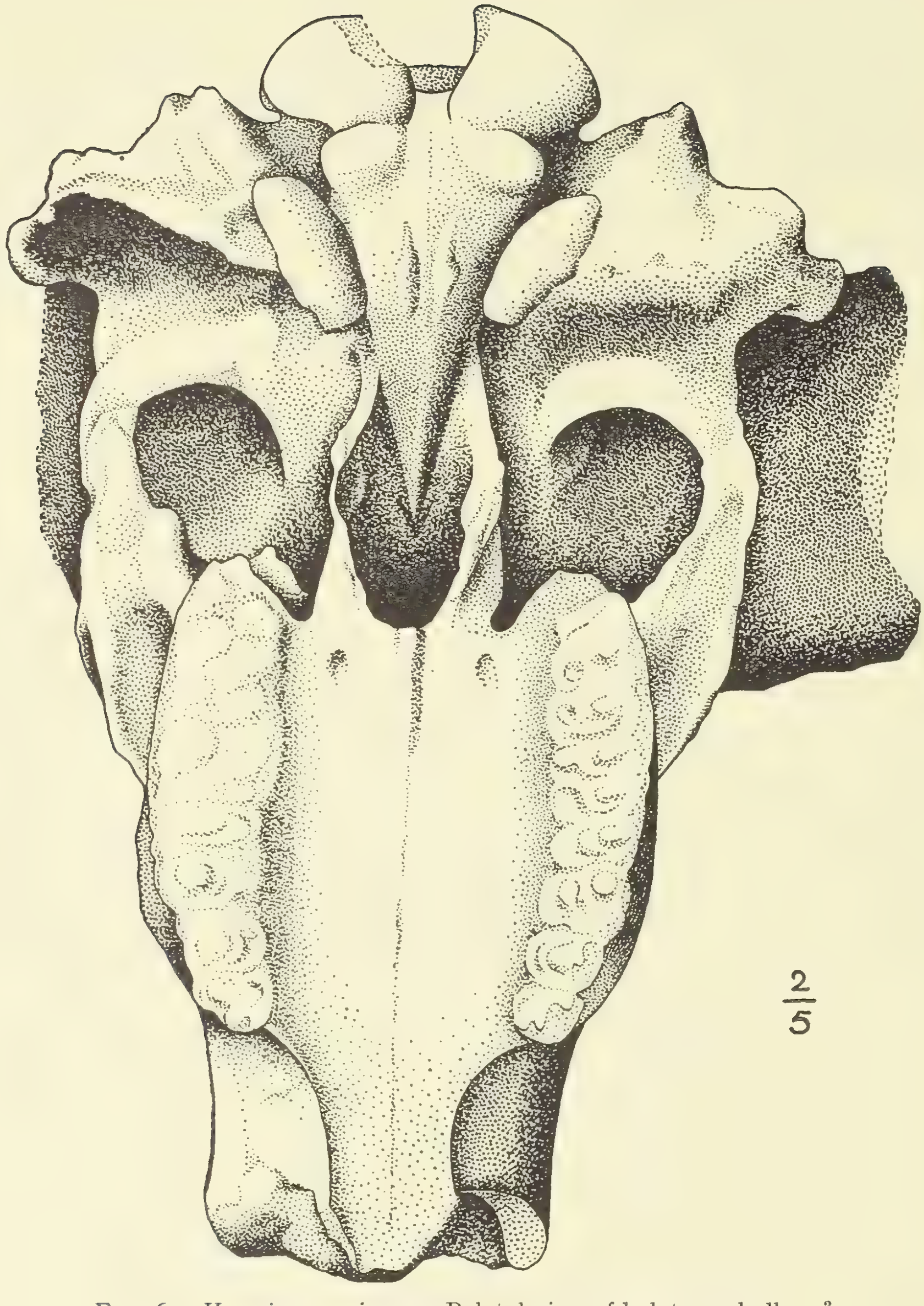

Fig. 6. *Homoioceras singae.* Palatal view of holotype skull, $\times\frac{2}{5}$.

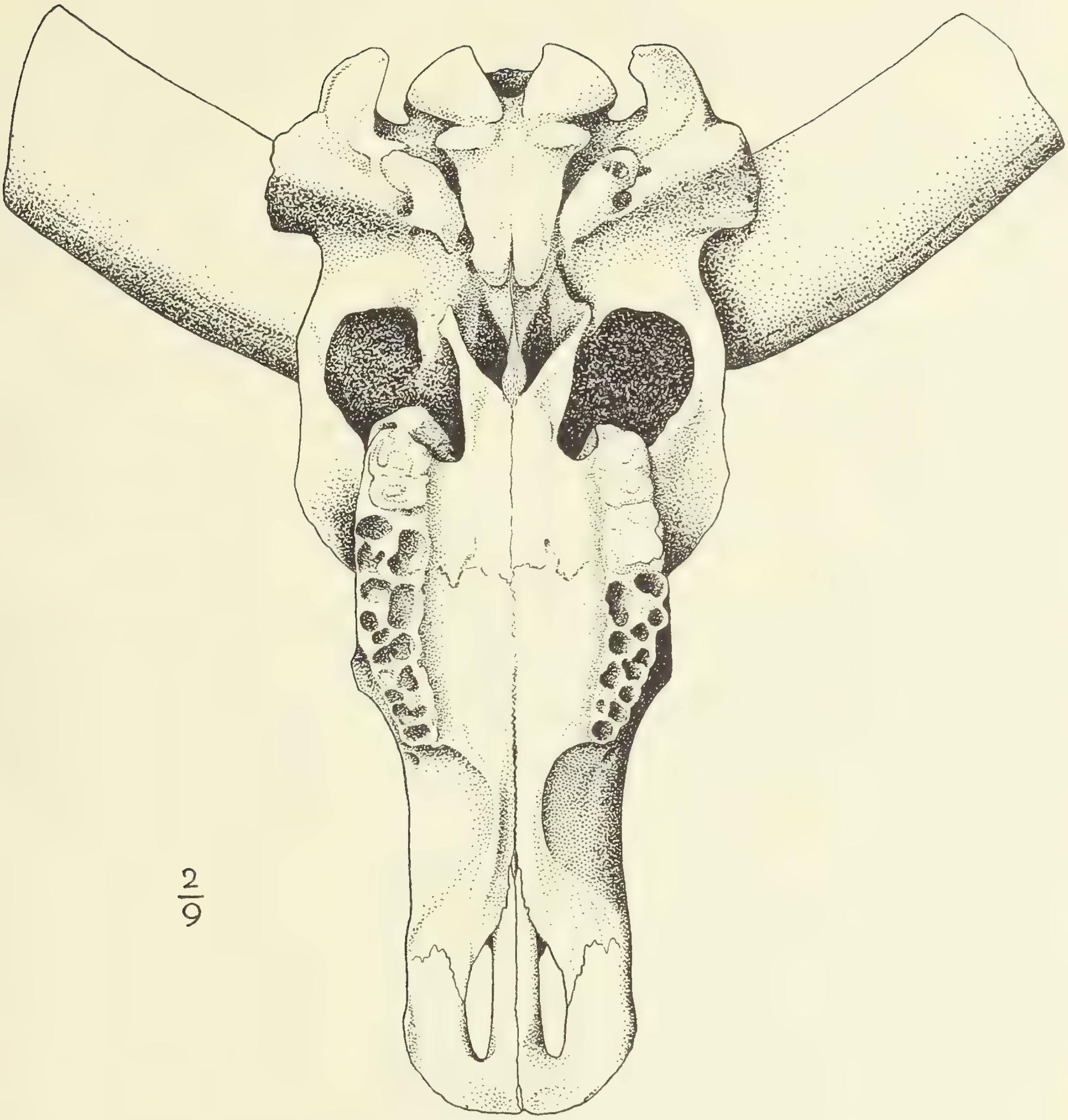

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FIG. 7. *Bubalus bubalis*. Recent skull from India. Palatal view, ×$\frac{2}{9}$.

Comparison with other African Fossil Species

Three other fossil species have been referred to above as belonging to the same genus as *H. singae.* The first known fossil buffalo from Africa is "*Bubalus*" *antiquus,* described by Duvernoy (1851) from the upper portion of a skull from Setif in Algeria. It is unfortunate that his holotype is incomplete, since a number of nearly complete skulls have since been discovered. Furthermore it is difficult to be sure that it represents a species identical with other north African examples, such as those figured so carefully by Pomel (1893) and by Thomas (1881). There is a cast of Duvernoy's type in the British Museum (Natural History) and this shows that it is specifically distinct from *H. singae.* Particulars in which it shows differences from the corresponding parts in *H. singae* are that the skull and horns are considerably larger, the section of the horn core is very different (fig. 8a, 8c), and the front of the horn cores in the Algerian specimens are deeply scored by longitudinal grooves. Another important distinction is seen in the basi-occipital which rises at an acute angle in *H. singae,* but mounts at a gentle slope in the far larger *H. antiquus* (holotype). The basi-sphenoid rises at the same angle in both species.

The skulls of *H. antiquus* figured by Thomas (1881) and Pomel (1893) show clearly that they represent a species not identical with, but belonging to the same group of Buffaloes (Syncerina) as *H. singae.* This is seen in the short and broad face, the short palate, which has no contact with the vomer, and in the horn cores which emerge practically at right angles to the skull; also in the short contact between the nasals and the premaxillae.

Remains of *H. antiquus* have been found plentifully in north Africa, chiefly Algeria, and the species persisted through a considerable period of time. It is known from the early Pleistocene (Romer, 1928), Professor Arambourg (1934) claiming it as part of the north African fauna from the Lower Palaeolithic, and as common in the Middle Palaeolithic. That it probably lived on to a still later date is shown by numerous representations preserved on rock surfaces (e.g. Pomel, 1893, pl. 10; see fig. 10). M. Lavauden (1927) has reproduced a spirited engraving of a fight between two bulls taken from a work of M. Flamand which I have not had the opportunity of seeing. There are many other records of specimens and engravings of these buffaloes in north Africa, but they do not concern us here.

A provisional list of fossil mammal remains found at Gau [or Qau], near Asyut, has been published by Professor D. M. S. Watson (1929: 541) from a deposit of uncertain, but probably Pleistocene, age. The species include extinct forms of Giant Cape Buffalo, Hartebeest, and Crocodile. When this collection is studied in detail it will be interesting to learn whether the buffalo is related to the north African species, or to *H. singae,* an inhabitant of the same great river valley.

The mammalian fauna from Kom Ombo, north of Aswan, at Vignard's Sebilian site, has recently been referred to at some length (Bate, 1949) and it is only necessary to mention here that it included a new species of buffalo, "*Bubalus*" *vignardi* (Gaillard, 1934). This is represented by some teeth and by an imperfect horn core, which is figured together with a drawing of its cross-section, neither of which resemble the condition seen in any other known buffalo.

The fine buffalo, *H. nilssoni,* discovered in an Upper Gamblian deposit in Kenya (Nilsson, 1940) and described by Lönnberg (1933), while evidently belonging to the same genus as *H. singae,* is certainly specifically distinct. The drawing of the under-side of the skull, taken from a photograph (fig. 9b) kindly sent by Dr. Nilsson, shows that this is long and narrow compared with that of *H. singae* (fig. 6), and that the bases of the horn cores emerge at a different angle. While the Kenya skull is rather long, both its comparative length, its other proportions, and also the character of the horn cores are quite different from the condition seen in the skull of the Recent *Bubalus* (fig. 7).

A few records may be briefly mentioned, since they may eventually prove to refer to remains of *Homoioceras.* Dr. Hopwood included a large bovine in the Kaiso fauna (1926: 31), and Professor Arambourg (1947) mentions buffalo remains (*Syncerus* aff. *brachyceros*) from Omo, a deposit which is probably of corresponding geological age. The latter author (1947: 521) has published a list of species from the "Villafranchean des plateaux Constaninois" which contains "*Syncerus* aff. *brachyceros* Gray", but I do not know if these remains have yet been described in detail. Dr. L. S. B. Leakey (1946: 41) has recorded, but without description, remains of a bovid of the *Bubalus* type from an Upper Pleistocene deposit at Lake Eyasi, from which portions of human skulls have been obtained. Recently Dietrich (1950) has recorded remains of "*Buffelus* cf. *palaeindicus*" and of *Syncerus caffer* sub-sp. from late Quaternary deposits of the Serengeti plain.

Yet another skull believed to be that of a *Homoioceras* has been found at a depth of 40 feet in the bank of the river Modder, a tributary of the Orange river, South Africa. This specimen was rather inadequately described by Seeley (1891), but the figure he gives certainly suggests that this buffalo should be known as *H. baini.* With the meagre information available it is not possible to make any close comparison with *H. singae.* Remains of this buffalo are not uncommonly found in Pleistocene deposits in South Africa, and Dr. L. H. Wells tells me that these deposits cover a considerable range of time, probably through the Kamasian to the end of the Gamblian. Scott (1907: 256) has described remains of a bovine from Zululand which he named *Bubalus andersoni.*

To conclude the record mention must be made of the discovery some years ago of a buffalo skull in a wadi near Bizerta, Tunisia (Solignac, 1924). This, it is claimed, represents *Bubalus palaeindicus* Falconer, which Pilgrim considered to be a variety of the Recent *B. bubalis* (Pilgrim, 1939: 256), or possibly identical with *B. macroceros* from Assam (Pilgrim, 1947: 277). Unfortunately the under-side of the Bizerta skull is very poorly preserved and, from the figure, the structure of the palate and the surrounding areas cannot be seen. The skull certainly appears to be long and narrow, but apart from this there does not seem to be any character which would exclude it from the section Syncerina. The figure of the hinder portion of the skull, together with the position of the horn cores, suggests a close resemblance to *H. antiquus.* It seems, therefore, that further and more definite information is required before *Bubalus* can be accepted as forming part of the north African fauna.

The above gives a brief survey of our present knowledge of the species of African long-horned fossil buffaloes. There are a number of records of the finding of fragmentary bovine remains in caves, gravels, and other deposits, but these give little

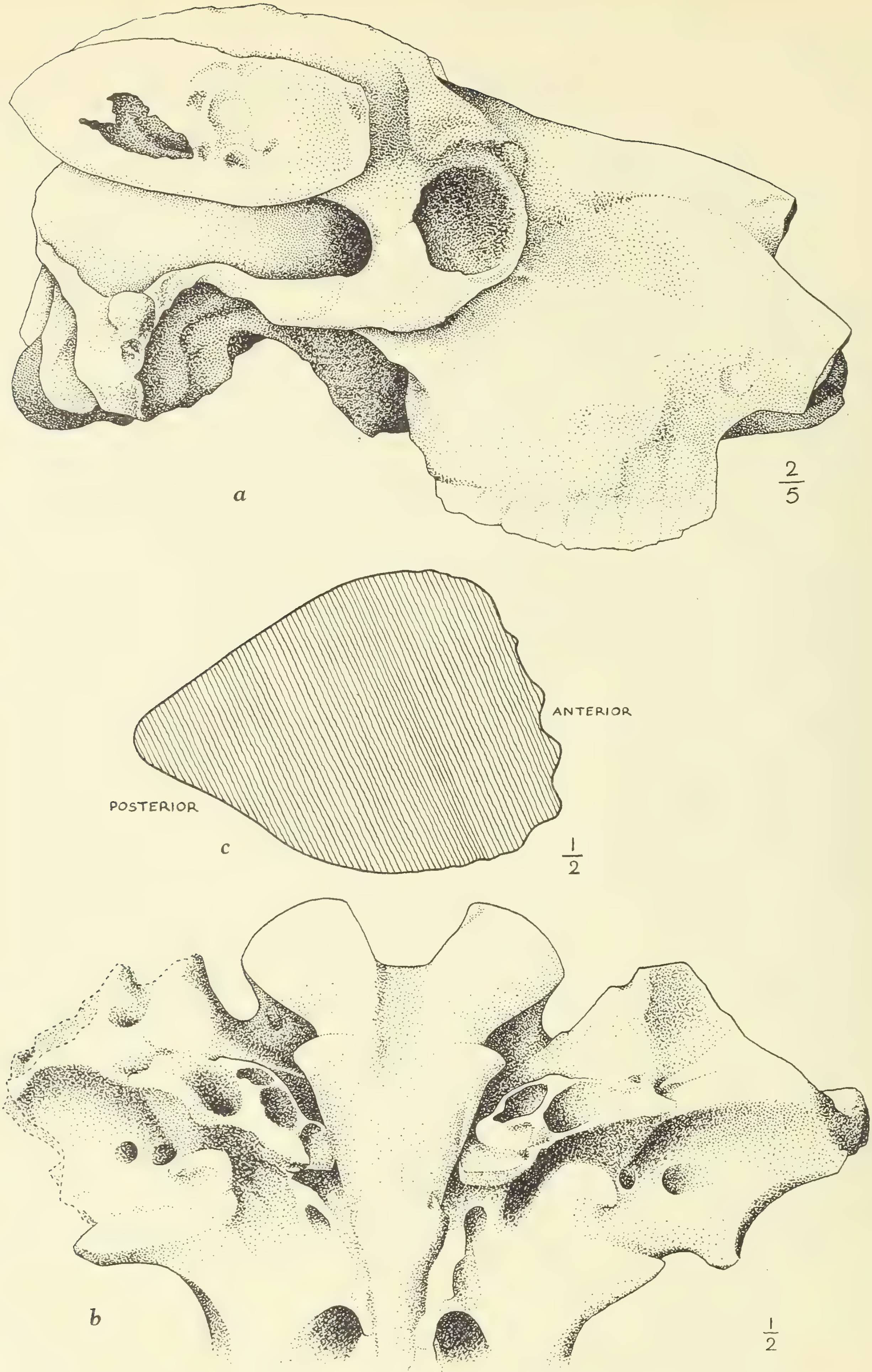

FIG. 8. (a) *Homoioceras singae.* Lateral view of holotype skull, $\times \frac{2}{5}$.
(b) *Homoioceras antiquus* (Duvernoy). Basi-cranium of holotype from Algeria, $\times \frac{1}{2}$.
(c) Section of horn core of *H. antiquus*, holotype, $\times \frac{1}{2}$.

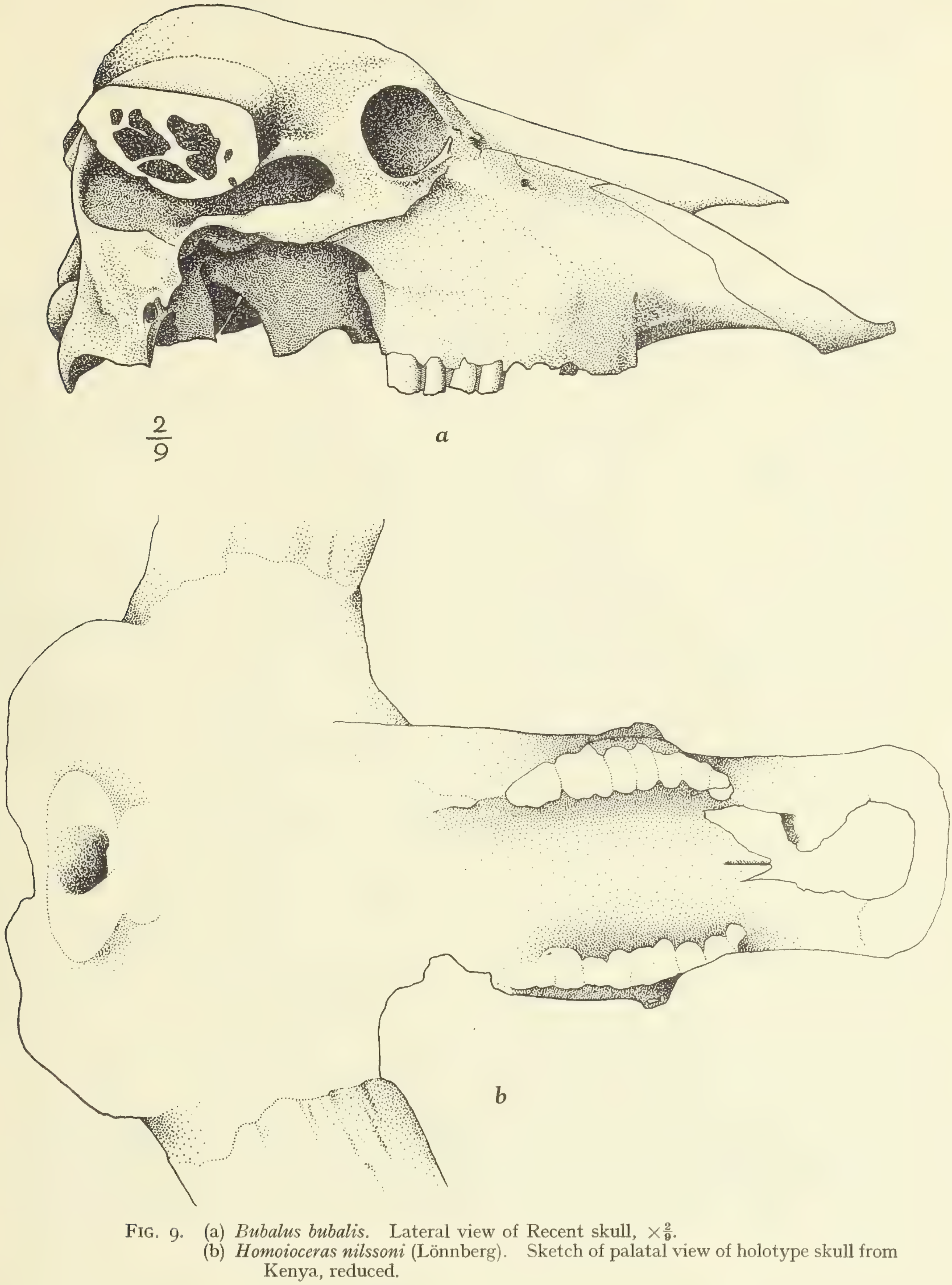

FIG. 9. (a) *Bubalus bubalis*. Lateral view of Recent skull, $\times\frac{2}{9}$.
(b) *Homoioceras nilssoni* (Lönnberg). Sketch of palatal view of holotype skull from Kenya, reduced.

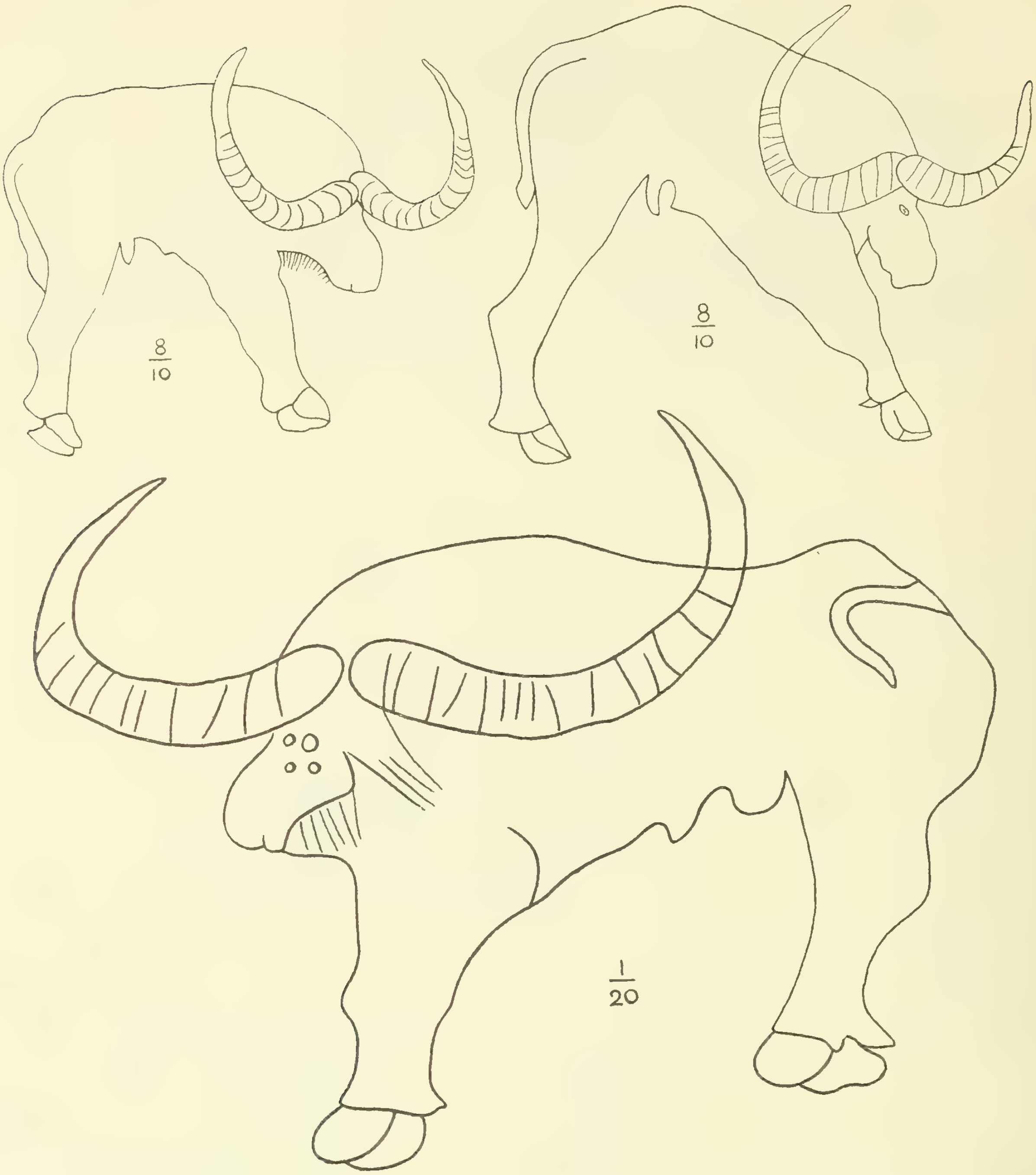

FIG. 10. *Homoioceras* cf. *antiquus* from rock engravings, Algeria. After Pomel, 1893.

information as to the identity of the species. At present it seems to be possible only to put on record some of the differences now known to exist between the several forms of African long-horned buffaloes. Even so this is important, for later when more details are known of their morphology, and of the geological horizons in which they occur, it may be possible to discover whether these differences are due to evolutionary or ecological causes, or even perhaps in part to riotous development in an unrestricted continental setting.

There is one further important discovery that should be referred to; this is the finding in a cave breccia in the Transvaal of the frontlet and horn cores of a dwarf buffalo about the size of the Congo *S. nanus*. This species described as "*Bos*" *makapaani* by Dr. R. Broom (1937) has horn cores which, from the published figures, appear to be distinct from those of any known fossil or Recent species. They may represent a species of a hitherto unknown lineage of buffalo, or one that may perhaps have some connection with the *S. caffer* group. This discovery confirms the opinion that had already been reached, that the long-horned fossil species, while belonging to the Syncerina section, are quite distinct from, and have not given rise to, the Recent *Syncerus*. It seems not unlikely that both *Homoioceras* and *Syncerus* are entirely African products.

The Systematic Position of the Fossil Long-horned Buffaloes of Africa

The generic distinction between the Asiatic *Bubalus* and the Recent African *Syncerus* has been made abundantly clear, and is now generally accepted. What is not so clear is an understanding of the systematic position of the fossil long-horned African buffaloes. In his great work on the fossil Bovidae of India Dr. Pilgrim (1939: 23) set out a classification of the Bovidae in which he divided the Bovinae into four "generic groups". These are Bubalina, Syncerina, Leptobovina, and Taurina. In a later work (1941: 161) this author says: "The ancestry of *Syncerus*, the modern African buffalo, is still unknown. It belongs to a lineage quite distinct from the Indian buffalo, *Bubalus*, though both are probably descended from a primitive species of *Proamphibos*." [Lower Pliocene.]

It is here claimed that through the study of the almost complete skull of *H. singae*, as well as the descriptions and figures of other African long-horned fossil species it is clearly proved that the African fossil genus *Homoioceras* should, together with the Recent *Syncerus*, be included in the Syncerina.

Pilgrim never himself examined any of the fossil African buffaloes, and merely quotes them as being considered as belonging to the type of Indian buffalo (1939: 255). Lönnberg (1933) in describing *H. nilssoni* says " . . . the African Buffaloes also from the beginning are of Asiatic origin", although he recognized that the Kenya species is closely related to the north African extinct *H. antiquus*. Thus he seems to go back on his own earlier opinion that " there cannot have been any genetic connection between the Asiatic buffaloes and the African ones, at least not between the present time and the Pliocene epoch " (1901: 44–45).

As late as 1947 (p. 437) no less an authority than Professor C. Arambourg wrote "Les Buffles fossiles africains jusqu'ici décrits se rapportent tous au genre asiatique *Bubalus* . . .", although he recognizes that the Recent African buffaloes differ in cranial characters, and probably belong to a line distinct from *Bubalus*.

In view of this persistent misunderstanding regarding the systematic position of the fossil long-horned African buffaloes it seems necessary to go into the matter carefully, so that there may no longer be excuse for perpetuating this misinterpretation of the facts regarding these fossil species which belong to the same generic group as Recent *Syncerus*.

The genus *Syncerus* was founded by Hodgson (1847) in a paper on ruminants of India, where he briefly states in a footnote (p. 709) that he considers that the Recent African buffaloes are not true buffaloes (*Bubalus*) and suggests the name *Syncerus* in reference to their "united horns". The use of the generic name *Syncerus* was stressed in a short paper by Hollister (1911).

Rütimeyer in his classic work on the Tertiary Bovidae (1878) suggested that, in spite of the great difference in size, the north African fossil *H. antiquus* is most closely related to the Recent *Syncerus brachyceros* from the Lake Chad area. However, as M. Lavauden (1927: 32) has rightly pointed out, *H. antiquus*, which at times attains a gigantic size and has doubtless reached the end of an evolutionary line, cannot be considered as directly ancestral to the Recent African buffaloes as Rütimeyer was inclined to believe.

In 1901 Lönnberg drew up a number of characters, chiefly of the skull, which he considered distinguished the Recent African buffaloes, and *H. antiquus*, from the Asiatic buffaloes. A list of these, together with other characters, was drawn up later by Pilgrim (1939), and the most important may be briefly tabulated thus:

	African		Asiatic
	Recent *Syncerus*	Fossil *Homoioceras*	Recent *Bubalus*
Short broad face	X	X	—
Long narrow face	—	—	X
Short palate and no fusion between vomer and palatines	X	X	—
Fusion of vomer with palatines	—	—	X
Short wide nasals	X	X	—
Premaxillae not, or only slightly, in contact with nasals	X	X	—
Premaxillae with long contact with nasals	—	—	X
Basi-occipital long isosceles triangle in shape	X	X	—
Basi-occipital quadrate and sharply truncated anteriorly	—	—	X

The above characters of the African fossil buffaloes can all be clearly seen in the figures of the skull of *H. singae* (figs. 4, 6, and 8a), and in Pomel's figures of *H. antiquus* (1893). The figure of the under-side of the skull of Recent *Bubalus* (fig. 7) also shows a number of its distinctive elements. There are, of course, other, but less important differences. The above are primitive characters, and regarding these I cannot do better than quote again from Pilgrim (1939: 255): "Since *Proamphibos* and *Hemibos*, the earliest known members of the *Bubalus* lineage, already have the vomer fused with the palatine, and the palate prolonged far behind the teeth, we may deduce that the *Syncerus* [now to include *Homoioceras*] lineage had branched off, at any rate as early as the Pontian, probably in a forested region still unknown. . . ." This forested region may now be located in Africa with some certainty, though definite proof of the presence of ancestral forms is still awaited. Of somewhat uncertain significance in this direction is the discovery of a single bovine tooth in the Wadi Natrun Pliocene (Andrews, 1902) which has been doubtfully referred to *Parabos* by Pilgrim (1941: 161); this genus is one of the earliest true buffaloes known from the Lower Pliocene of Europe. Professor Arambourg (1947: 511) has since thrown doubt on this identification, and also on the Middle Pliocene age of the deposit, which he considers more likely to be Lower Pleistocene, a suggestion supported by my preliminary study of mammals related to those of the Wadi Natrun. It has also been surmised (Pilgrim, 1941: 161) that the large bovid, *Bularchus arok* from Olduvai (Hopwood, 1936), might have to be included in the African buffalo complex.

It will be seen from the above that the African genera *Homoioceras* and *Syncerus* resemble each other in essential and primitive skull characters; they differ in minor skull characters and in the totally dissimilar shape of the horns. The extreme plasticity seen in the genus *Syncerus*, from the dwarf *S. nanus* to the mighty *S. caffer* (Christy, 1929), suggests that its existence is not of very long standing, but as yet practically nothing is known of its immediate ancestry.

Summary

A description is given of a collection of Pleistocene animal remains from deposits on the Blue Nile, at Singa and Abu Hugar south of Khartoum. This is only the second collection of the kind from the Sudan to be fully described. Added interest arises from its association with a human skull of Pre-Bushman type and with stone artifacts.

The chief character of the fauna as a whole is that it comprises mainly extinct forms, many of the species being quite distinct from those found living in the country at the present day. Proof of this is shown by the presence of a species of Buffalo belonging to an extinct lineage, and of an extinct Porcupine of a type more generalized than Recent forms. Besides this there are specimens not definitely determinable, but almost certainly belonging to extinct genera. These are a ?Sivatherine and an ?Antilopine, bones of which are figured.

The beautifully preserved skull of a Buffalo which is included in the collection has provided not only the opportunity of describing a hitherto unknown species, but it has also enabled a review to be made of the fossil long-horned buffaloes of Africa. These are proved to be entirely distinct from the Asiatic buffalo, *Bubalus*. They are related to the Recent African buffaloes, *Syncerus*, but represent a different group, for which the genus *Homoioceras* has been instituted.

Sufficient details are not as yet available regarding the geology of this rather inscrutable area for it to be possible to suggest a definite dating. (See Andrew *in* Tothill, 1948.) As a general group the animal remains are undoubtedly "Upper Pleistocene", but may not belong to the latest phase of the period. This is indicated, not only by the character of the species, but also by the fact that the bone deposit underlies about fifteen metres of later formations. Changes are continuously and gradually taking place in the composition and status of all faunas, but it has long been known that a big faunal change took place in Europe during the latter part of the Pleistocene period. More recently (Bate, 1937) it has been found that a similar

change occurred in Palestine (between the Lower and Upper Levalloiso-Mousterian levels). A similar faunal break has likewise been recorded in East Africa (between the Upper Kamasian and the Gamblian stages). This seems to suggest that it probably took place in many, if not all, parts of the continent, and presumably in the Sudan at the stage correlated with the forming of the Rift Valleys, see stage marked " ?Earth movements" in Mr. A. J. Arkell's Succession Table (1949*a*).

In the fauna from Singa the Buffalo perhaps, though not necessarily, suggests a time later than the period of ?earth movements and faunal change, whereas the ?Sivatherine would seem to antedate these events. I am at present inclined to favour the earlier date, but a greater knowledge of this fauna and of faunas from other localities alone can solve this fascinating problem. Further there is yet one other point to be remembered, and that is that since most of the specimens were found weathered out of their original layer (Grabham, 1938 and Arkell, 1949*a*), there is the possibility of the presence of representatives of two faunas.

Much gratitude is due to Mr. A. J. Arkell for making this interesting collection available for study, and to the Sudan Government for enabling this to be carried out at the British Museum (Natural History). I also wish to thank Dr. L. R. Cox and Dr. W. E. Swinton for kindly examining the shell and the crocodile skull, and Dr. A. T. Hopwood for helpful talks on African mammals. I would specially record my grateful thanks to the artists, Mr. A. J. E. Terzi and Mr. D. Woodall, for their drawings which help so greatly to illustrate and clarify the facts expressed in the text.

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THE FOSSIL HUMAN SKULL FROM SINGA

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The Singa skull (B.M. Geol. Dept. M. 15546) was originally described by Sir Arthur Smith Woodward (1938). It has since been recognized that the horizon to which the skull can be assigned carries stone artifacts and an extensive mammalian fauna including several extinct species. This evidence, presented in the accompanying reports by Mr. Lacaille and Miss Bate, confirms the genuine antiquity of this find.

Smith Woodward concluded that the Singa specimen "differs from all human skulls hitherto described as found fossil in North Africa", and much more closely resembled Bushman skulls from South Africa. He asserted that "it may indeed be regarded as an ancestral Bushman", qualifying this statement with the remark that "in its more important features the Sudan fossil agrees still more closely with the fossil Boskop skull which was found in 1913 in the Transvaal". With these opinions in mind, I have gratefully welcomed the opportunity of studying this fossil in the light of the Bushman and pre-Bushman material from South Africa already known to me.

This study has satisfied me that Smith Woodward was essentially correct in his interpretation of this fossil and that this can be further substantiated by reference to other South African material not available to him. I feel, however, that certain of its peculiarities deserve more emphasis than he gave them. Moreover, since he described the skull, Mr. L. E. Parsons of the Department of Geology has been able to remove more of the adherent matrix, so that features previously obscured can now be examined.

I propose in describing this skull to compare it with that of the Recent Bushman and with the Boskop and other fossils from South Africa, so as to bring out its intimate relation to them. Possible resemblances to fossils from areas closer to the Sudan will be touched on later, in surveying the broader implications of the Singa find.

Comparative Description of the Singa Skull.

The remains comprise the almost complete braincase with the upper interorbital region and the outer wall of the left orbit. There are a few defects in the cranial walls; the outer half of the right superior orbital margin is wanting, and there is a fracture through the right temporal fossa, but the braincase does not appear to have been appreciably distorted. The nasal bones have been fractured and partly displaced, and the temporal process of the left zygoma is somewhat warped. The bone is heavily mineralized; in this respect as well as in the character of the matrix the skull resembles the other fossils from this horizon.

From the ossification of the cranial sutures the individual was mature and probably middle-aged; the size and robust structure indicate a male.

The first impression created by this skull was one of a singular lack of harmony between the frontal and supraorbital regions and the posterior part of the braincase. So marked was this that had the two portions been found separated, one might have hesitated to unite them. When the skull is considered in relation to South African finds, however, this seeming incongruity disappears. Nevertheless it seems appropriate, in describing this specimen, to deal first with the characters of the posterior portion and then with those of the frontal and facial regions.

In Table I the principal dimensions of this skull are compared with those of some

TABLE I

MEASUREMENTS OF SINGA SKULL COMPARED WITH TYPICAL BUSHMAN AND "STRANDLOOPER" SKULLS

	Singa	Oxford AF. 63	Oxford AF. 63	Oxford AF. 63	Oxford AF. 63	Oxford AF. 63	Oxford AF. 63	B.M. 1898	Oxford AF. 64	B.M. 1911	Range and Mean fo "typical" Bushn skulls (Keen, 194	
		418	419	420	421	1067	1070	4.29.1	1	11.14.7	Range	Me
Maximum length . .	189 mm.	178 mm.	172 mm.	172 mm.	171 mm.	171 mm.	165 mm.	179 mm.	177 mm.	186 mm.	165–181 mm.	174·7
Maximum breadth . .	155 ,,	134 ,,	134 ,,	135 ,,	135 ,,	132 ,,	135 ,,	136 ,,	142 ,,	141 ,,	123–145 ,,	132·6
Basi-bregmatic height .	129 ,,	127 ,,	121 ,,	118 ,,	130 ,,	117 ,,	123 ,,	122 ,,	128 ,,	132 ,,	114–126 ,,	121·8
Minimum frontal breadth	105 ,,	94 ,,	93 ,,	89 ,,	90 ,,	88 ,,	98 ,,	96 ,,	86 ,,	89 ,,	86– 98 ,,	91·9
Supraorbital breadth .	122 ,, ?	102 ,,	102 ,,	102 ,,	100 ,,	97 ,,	108 ,,	104 ,,	97 ,,	105 ,,	—	—
Interorbital breadth .	28 ,, ?	22 ,,	23 ,,	24 ,,	23 ,,	20 ,,	28 ,,	29 ,,	19 ,,	22 ,,	—	—
Orbital breadth . .	45 ,,	36 ,,	37 ,,	36 ,,	36 ,,	33 ,,	37 ,,	36 ,,	39 ,,	35 ,,	—	—
Orbital height . .	35 ,, ?	28 ,,	32 ,,	30 ,,	31 ,,	29 ,,	32 ,,	29 ,,	28 ,,	27 ,,	—	—
Cranial index . .	82·0	75·3	77·9	78·5	78·9	77·2	81·8	76·0	80·2	75·8	69·0–83·0	75·8
Altitudinal index . .	68·3	71·3	70·3	68·6	76·0	68·4	74·5	68·2	72·3	71·0	66·0–73·0	69·2
Vertical index . .	83·2	94·8	90·3	87·4	96·3	88·6	91·1	89·7	90·1	93·6	85·0–99·0	92·0
Fronto-parietal index .	67·7	70·1	69·4	65·9	66·7	66·7	72·6	70·6	60·6	63·4	62·0–76·0	69·3
Fronto-supraorbital index	86·1?	92·2	91·2	87·3	90·0	90·7	90·8	92·3	88·7	84·8	—	—

representative Bushman skulls from the British Museum and Oxford University collections. For some measurements it has been possible also to include the range and mean for a series of 31 "typical" Bushman skulls published by Keen (1947). The Singa skull is considerably larger than those of Bushmen in all dimensions except basi-bregmatic height and interorbital breadth, in which it lies at the upper limit of the Bushman range. Table II shows the measurements of this skull in comparison with those of the Boskop and other "pre-Bushman" skulls from South Africa except for the Ingwavuma skull (Cooke, Malan & Wells, 1945); these are taken from Galloway (1937). The Boskop skull is almost identical with the Singa skull in its transverse diameters, but it is very much longer; the other skulls listed are all somewhat longer and considerably narrower than the Singa specimen.

The great breadth and moderate length of the Singa skull combine to make it just brachycranial. It thus falls, as Smith Woodward has remarked, at the upper end of the Bushman range. Most of the pre-Bushman skulls are dolichocranial, only the Boskop and Fish Hoek specimens entering the mesaticranial class in which the Bushman average lies.

Viewed from above (fig. 1), the parietal region of the Singa skull is notably asymmetrical, the right parietal eminence being considerably more prominent than the left. Both eminences however are distinctly foetal in character, giving to the braincase an obtusely pentagonal cranial form. The greatest breadth is found at the level of these eminences, and the transverse contour of the vault between them is strikingly flattened. There is a broad interparietal depression along the posterior

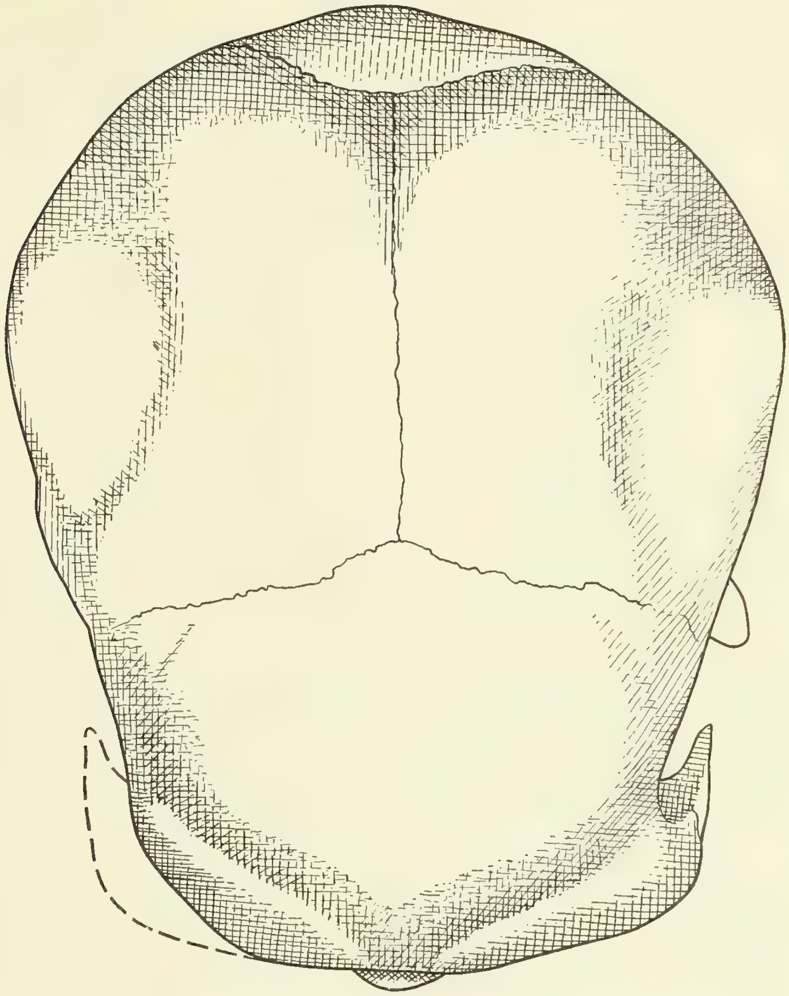

FIG. 1. Norma verticalis of Singa skull. (Natural size.)

third of the sagittal suture. In these features, as in the breadth measurement, the Singa skull is remarkably similar to the Boskop calvaria, but the same flattening is also found in the Bushman. The occiput appears shorter and more rounded in this view than that of the Boskop skull, being similar in contour to those of many Bushman skulls.

In a lateral view (fig. 2), the highest point of the cranial contour is seen to be at the bregma. From this point it descends gently to the mid-parietal region, and then in a steep curve to the short, slightly flattened occiput. The external occipital protuberance

Table 2

MEASUREMENTS OF SINGA SKULL COMPARED WITH SOUTH AFRICAN "PRE-BUSHMAN" SKULLS

	Singa	Boskop	Fish Hoek	Cape Flats	Spring-bok Flats	Matjes River M.R.1	Ingwa-vuma
Maximum length	189 mm.	205 mm.	200 mm.	191 mm.	195 mm.	193 mm.	195 mm.?
Maximum breadth	155 ,,	154 ,, ?	151 ,,	132 ,,	144 ,,	131 ,,	140 ,,
Porio-bregmatic height	115 ,,	115 ,, ?	114 ,,	107 ,,	120 ,,	114 ,,	115 ,,
Minimum frontal breadth	105 ,,	103 ,,	105 ,,	—	—	90 ,,	108 ,,
Supraorbital breadth	122 ,,	119 ,, ?	111 ,,	—	106 ,, ?	102 ,,	120 ,, ?
Interorbital breadth	28 ,, ?	—	28 ,,	—	—	—	—
Orbital breadth	45 ,,	—	40 ,,	44 ,,	—	—	—
Orbital height	35 ,, ?	—	30 ,,	33 ,,	—	—	—
Cranial index	82·0	75·1?	75·5	69·1	73·8	67·9	71·8?
Porio-bregmatic altitudinal index	60·8	56·1?	57·0	56·0	61·5	59·1	59·0?
Fronto-parietal index	67·7	66·9?	69·5	—	—	68·7	77·1
Fronto-supraorbital index	86·1	86·6?	94·6	—	—	88·2	90·0?

and inferior nuchal line are faintly marked, but their position is emphasized by a transverse groove crossing the posterior part of the nuchal surface. More anteriorly this surface is somewhat convex, more decidedly so on the right side than the left. The whole contour of the occipital region can readily be matched among Bushman crania; in the Boskop skull the parieto-occipital slope is less steep and the occiput more projecting.

As in Bushman skulls, the articular surfaces of the occipital condyles are very flat, but the medial margins of the condyles are elevated so that the articular surfaces are directed as much laterally as inferiorly (fig. 3). Although the margins of the foramen magnum are damaged, it was clearly short antero-posteriorly and broad transversely. It thus recalls the relatively small circular foramen observed by Gear (1926) in a cranial fragment resembling the Boskop type.

In conformity with the depressed vault of the braincase, the temporal bone is low, the highest point on the parieto-temporal suture rising little if at all above the level of pterion (fig. 2). Posteriorly this suture falls obliquely to the supra-mastoid region. The cranial wall above and below this suture is slightly convex. This convex merges above into the parietal eminence; below and anteriorly it ends in a swelling along the temporo-sphenoidal suture, referred to in descriptions of the Bushman skull as the *mons temporo-sphenoidale*. As in the Bushman also, a shallow "Sylvian" depression separates this swelling from an oval eminence which overlies the inferior frontal convolution. In a study of the Bushman endocranial cast (Wells, 1937) this modelling of the cranial wall has been shown to be determined by the development of the underlying brain.

As fig. 2 shows, the mastoid process is narrow and short, its tip descending some 20 mm. below the Frankfort plane, which is less than the average (22·5 mm.) determined by Keen (1947) for the Bushman. The digastric impression extends over the base of the braincase medial and posterior to this process. On the outer side of the process is a blunt oblique ridge for the sterno-mastoid muscle; a narrow shallow groove separates this ridge from the thick blunt supra-mastoid crest. This crest passes backwards and upwards into the hinder end of the temporal line, while anteriorly it merges above the external auditory meatus with the relatively thick rounded posterior root of the zygomatic arch. The temporal bone as a whole and the mastoid region in particular have thus a generally infantile character resembling those of the Bushman, but combine with this a robust build which makes them more comparable with the Boskop skull. However, the mandibular fossa is deeper and the articular eminence more convex than in either the Bushman or the Boskop skull. The tympanic plate of the temporal bone appears to be thick.

So far as the hinder portion of the braincase is concerned, the most important features which the Singa skull shares with the Bushman and Boskop skulls are essentially infantile or paedomorphic. They include the flattened parietal region and prominent angular parietal eminences, the depressed parieto-temporal suture, the small mastoid process, and the modelling of the temporo-sphenoidal region. As in the Boskop skull and in contrast to the Bushman, these paedomorphic features in the Singa skull are combined with large cranial dimensions and a robust build.

Viewed from above (fig. 1) the forehead appears very constricted by contrast with the broad frontal region. Nevertheless, although Smith Woodward's estimate of 110 mm. for the least frontal diameter is probably excessive, this measurement cannot have been less than 105 mm. which is still near to the upper limit of variation in modern human crania, and is slightly larger than the measurement in the Boskop skull. Table I shows the fronto-parietal index to be well within the range of variation in Bushman skulls; it is also practically identical with those of the Boskop, Fish Hoek, and Matjes River M.R.1 skulls (Table II).

To the eye, the apparent narrowness of the frontal region is greatly accentuated by its conformation. There is a distinct median frontal keel, commencing in a conical eminence just in front of the bregma and continuing to the glabella. The frontal bosses, unlike those of the Boskop skull and of most Bushman skulls, are indistinct, and merge medially into the frontal keel, while the lateral part of the bone falls away to the very depressed temporal line. This falling away, combined with the median keel, gives to the frontal bone a definitely trigonocephalic contour. Strongly marked trigonocephaly is emphasized by Sir Arthur Keith (1933) as a feature of M.R.1 and other skulls from the Matjes River Cave. A distinct median keel is also present in the Fish Hoek and Ingwavuma skulls as well as in some Bushmen but it is not apparent in the Boskop specimen.

The supraorbital margin of the Singa skull does not conform to the contour of the tabular portion, its lateral portion projecting forward as a bold shelf which ends in a broad triangular zygomatic process. The anterior projection of this shelf amounts to 10 mm. at the middle of the upper orbital margin, and 18 mm. at the base of the zygomatic process. A large part of the area known as the *trigonum supraorbitale* thus comes to face almost directly upwards. This supraorbital shelf has a narrower continuation medially above the superciliary eminence until it is interrupted in the mid-line by the frontal keel, which here emerges with the glabella and obscures its forward projection.

In a profile view (fig. 2) the median contour of the frontal bone descends in an almost unbroken curve from the pre-bregmatic eminence to the glabella, although the convexity of the latter is masked from the side by the more prominent superciliary eminence. Such a contour is strikingly different from that of the Boskop skull and of most Bushman skulls, even those in which a frontal keel is present, these skulls displaying a vertical forehead and a more or less sharp transition to the vault.

At its medial end the superciliary eminence is clearly defined from the glabellar convexity (fig. 3), but laterally it merges into the thickened rounded lateral supra-orbital margin. The superior orbital margin thus forms a continuous bar, conforming to Type III of Cunningham's classification (1908), i.e. a genuine *torus supraorbitalis*.

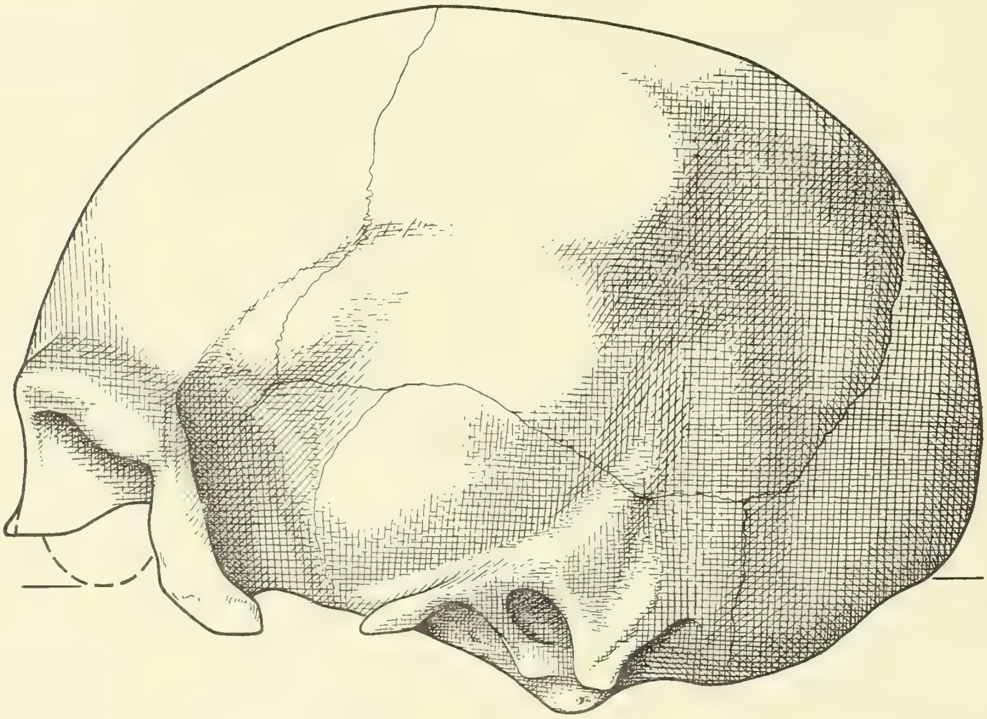

FIG. 2. Norma lateralis of Singa skull: the probable original profile of the nasal bones is indicated by an interrupted line. (Natural size.)

This torus is 12 mm. thick in its medial (superciliary) part, 10 mm. thick at the middle of the upper orbital margin, where the superciliary and supraorbital components meet, and 8 mm. thick at its lateral and most prominent part. The zygomatic process is directed laterally, only its abruptly tapered extremity being deflected downwards to articulate with the slender ascending process of the zygoma. Its anterior border forms an elongated oval tubercle, which is very conspicuous in a lateral view (fig. 3). This projection makes the ascending process of the zygoma appear to articulate behind rather than below the zygomatic process of the frontal, giving to the orbit a very strongly marked supero-lateral angle. Such an appearance is not characteristic of Bushman skulls, and can be more closely matched in some Australians. It implies that the zygoma has not been advanced to the same extent as the supraorbital margin, so that the lateral orbital margin lies in a plane very much posterior to the inter-orbital region. Nevertheless the zygoma and zygomatic process lie well in front of the eminence overlying the inferior frontal convolution, a depression some 10 mm. broad separating the anterior limit of this eminence from the nearly vertical posterior border of the zygomatic process. This relation expresses the trigonocephalic character of the tabular frontal. The marginal tubercle on the posterior border of the ascending process of the zygoma is very slightly developed, so that this border forms almost one vertical line with that of the zygomatic process.

Smith Woodward estimated the reconstructed supraorbital width of this skull as 128 mm., a measurement exceeding those of European Neanderthal skulls and approaching those of the Broken Hill and Florisbad fossils from Central and South

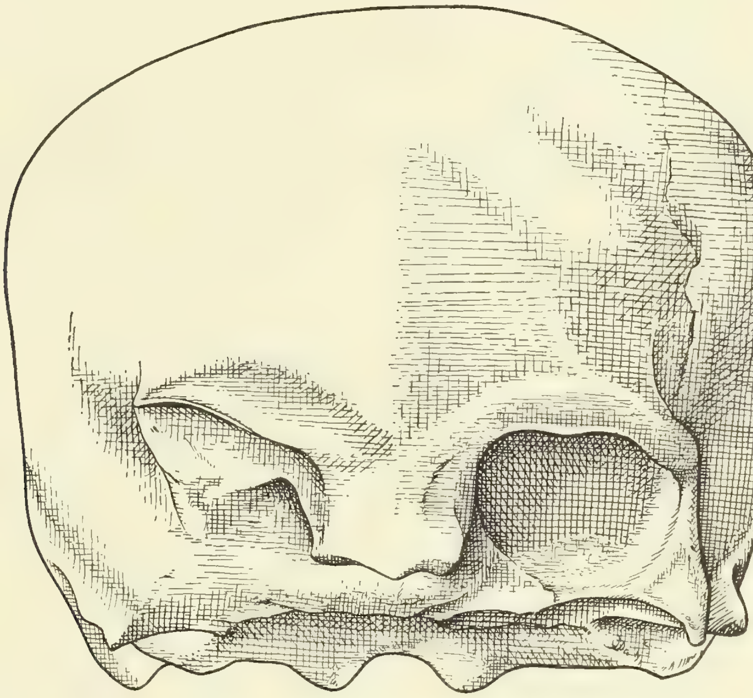

FIG. 3. Norma facialis of Singa skull. (Natural size.)

Africa. I consider that it should be reduced to about 122 mm., which is still a high figure compared with those for living types of Man (Keith, 1931, McCown & Keith, 1939). This breadth has been estimated at 119 mm. in the Boskop and 120 mm. in the Ingwavuma skull; in other "pre-Bushman" skulls it is considerably less.

In the Boskop, Fish Hoek, and Ingwavuma specimens the lateral supraorbital margin is thickened, and in the two latter it merges with the superciliary eminence to form a definite torus, but in none of them does it form a projecting shelf as in the Singa skull. Such a shelf is, however, developed to some extent in the trigonocephalic skull M.R.1 from the Matjes River Cave, although the supraorbital region of this fossil is thinner and the forehead much narrower. The prominence of the lateral supraorbital region in M.R.1 was first pointed out by Keith (1933), and has recently been stressed by Dreyer (1947). A similar development of this region is also present in the imperfect cranium from Canteen Kopje near Kimberley, described by Broom (1929) as "Australoid." In a recent study (Wells, 1948), I have maintained that the Canteen Kopje specimen is closely related to the Boskop skull, from which it differs chiefly in being narrower and in having smaller frontal eminences and a more projecting supraorbital region. This region in the Canteen Kopje skull thus forms a connecting link between those of Singa and Boskop.

It is not possible to measure the interorbital breadth quite exactly, and Smith Woodward's estimate of 30 mm. may be slightly too large. This figure, however, is almost equalled in some Bushman skulls. The nasion is slightly inset under the glabella, the nasal bones narrow and almost completely flat, and the nasal processes of the maxillae face more anteriorly than laterally. Thus the interorbital region, though not as extremely flat as in many Bushman skulls, is only slightly convex. The nasal bones have been fractured transversely post-mortem, and their lower portions deflected forwards, exaggerating the concavity of the nasal profile. In fig. 2 the probable original profile of this region is indicated by the broken line.

The orbital width cannot have been less than Smith Woodward's estimate of 44 mm., which is considerably more than in any Bushman skull, even among those with a very narrow interorbital region. This combination of very large orbital and interorbital breadths is clearly associated with the great supraorbital width. The orbital height was probably not as great as Smith Woodward suggested, an estimate of 35 mm. appearing more reasonable. It seems that the anterior fragment of the zygomatic arch has been warped out of its alignment with the posterior root either by a fracture of the arch during life or by post-mortem pressure, but the skull was clearly phaenozygous.

As the cranial cavity is still partially filled with matrix, its capacity cannot be directly measured, estimates made by various formulae all fall into the range 1550–1600 c.c. This may well be more than the true value on account of the angular contours of the skull, the narrow forehead and the projecting glabellar region, but the Singa skull undoubtedly belongs to the megacephalic group.

Relation of the Singa Skull to Prehistoric South African Crania

Smith Woodward, as has been stated, characterized the Singa skull as that of an "ancestral Bushman". He declared that "it differs chiefly in the greater prominence of the supraorbital ridges, and in the forward curvature of the nasal bones"; the latter feature, however, is partly an illusion due to post-mortem fracture and displacement. From this it might not seem that he laid sufficient weight upon the great size and robustness of the Singa skull which place it outside the "typical" Bushman range. Nevertheless he implicitly recognized these features in observing that "the Sudan fossil agrees still more closely with the fossil Boskop skull. . . . Its calvaria may indeed be described as a brachycephalic variant of the Boskop type."

The foregoing analysis can leave little doubt that the Singa skull, like that of Boskop, belong to the "Bushmanoid" division of mankind, whether this is regarded as a fundamental human type or merely as a variant of the Negro. On the information at Smith Woodward's disposal, his conclusions are undoubtedly warranted. But they confront us directly with some of the most debatable questions in South African physical anthropology: the origin of the Bushman type and the relation of the Boskop and other fossil crania to this type and to each other. The bearing of the Singa skull upon these questions must be considered in the light of discoveries and interpretations not available to Smith Woodward. A summary of the opinions held by leading authorities in South Africa upon these issues has been given elsewhere (Wells, 1948*a*).

Shrubsall (1907) first recognized among prehistoric South African crania a type more robust than that of the typical Bushman. To this he applied the name "Strandlooper", a usage since generally abandoned. An example of this type is the skull B.M. 1911: 11.14.7 (Table I). It will be seen that this skull, though both longer and broader than those of most Bushmen, is considerably smaller in both these dimensions than the Singa skull. Shrubsall, followed by Broom (1923, 1941) and to some extent by Dreyer (1947), regarded this robust type as the parent of the Bushman. Broom has further suggested that the Boskop fossil represents a still earlier stage in the same sequence, inferring that this paedomorphic stock has been progressively and drastically reduced in its cranial dimensions. Dart and his school, on the contrary, have regarded the giganto-paedomorphic Boskop and pygmaeo-paedomorphic Bushman as independent though related types, and suggested that the robust "Strandlooper" type of Shrubsall might have arisen by hybridization between them.

Some of the "Strandlooper" skulls, such as Oxford AF. 64/1 (Table I), resemble the Singa skull in being relatively broad. Galloway (1936) argued that these might be regarded as hybrids combining Bushman length with Boskop breadth. This is not strictly true; unlike the Singa fossil, these broad-headed "Strandloopers" are considerably narrower than the Boskop skull. Dreyer, Meiring & Hoffman (1938) have reversed this interpretation, regarding the Boskop skull as a hybrid between the short, broad Bushman type and a long, relatively narrower "Hottentot" type. These authors make the important suggestion that in hybridization between such types any of the cranial diameters may become larger or smaller than in either parent.

The Singa skull has been found to agree with that of Boskop in being definitely paedomorphic and at the same time robust. These skulls are also practically identical in their breadth measurements, but differ markedly in length and consequently in cranial index. This difference in proportions, even without the contrast in their frontal characters, makes it seem unlikely that they fall within the range of variation of a single type. It is true that their cranial indices lie within the Bushman range, but to our present knowledge they are not linked by a series of intermediate, mesaticranial specimens. Indeed the Boskop skull appears rather to be linked to a group of equally long but narrower crania such as that of Canteen Kopje. I consider that the term "Boskop type" should be limited to this group, and not extended, as by Galloway (1937) to embrace all "pre-Bushman" skulls.

If this view is adopted, the Singa skull cannot simply be referred to the "Boskop type". Either the Singa and Boskop fossils are different stages in development (not necessarily in one line) from a common ancestral stock, or their common heritage has been modified, in one or both, by hybridization. Such a conclusion is borne out by their contrasted frontal characters, in spite of the link provided by the Canteen Kopje skull. The existence of this link suggests that we may have here a single developmental sequence rather than two diverse types. On general principles one might suppose that such a sequence would proceed from a non-paedomorphic to a paedomorphic type, so that the Singa frontal would represent a more primitive stage than that of Boskop, but the converse is by no means impossible. It is also possible to conclude that the frontal regions of these two skulls represent diverse specializations, without necessarily assuming, as Broom (1941) does, that a prominent supraorbital region always belongs to an "Australoid" strain foreign to the Bushman-Boskop stock. Except for the Matjes River skull M.R.1, none of the "pre-Bushman" types listed in Table II approach the Singa fossil so closely as does the Boskop skull. Although the Fish Hoek and Ingwavuma skulls have comparable frontal and supraorbital diameters, their supraorbital development is dissimilar, and they are widely different in other respects. At the most, therefore, these skulls represent a divergent development from the same stock.

M.R.1 and the Singa skull are similar in length and height as well as in frontal characters, but are widely different in frontal and parietal breadth. The Singa fossil also is more robust in its supraorbital development, but in assessing this feature it must be remembered that according to Dreyer (1947) M.R.1 is female, whereas the Singa skull is almost certainly male.

Keith (1933) and Galloway (1937) associated M.R.1 with the Boskop type, a view which I can no longer accept. More recently Dreyer (1947) has strongly asserted the claim of M.R.1 to be regarded as ancestral to the Bushman type. He thus attributes to this specimen precisely the same significance that Smith Woodward ascribed to the Singa skull. Dreyer has shown that a continuous sequence can be traced from the supraorbital region of M.R.1 to that of the typical Bushman, and has suggested that M.R.1 links the Bushman with the still older Florisbad skull. He thus adopts the view that the history of the frontal region in this group has been one of increasing paedomorphic specialization. The Singa frontal region might plausibly be introduced into the sequence envisaged by Dreyer as a stage even preceding that of M.R.1. Its greater breadth would not preclude this if the extraordinarily broad Florisbad type is taken as the starting point. Alternatively it might form part of a parallel sequence leading to the Canteen Kopje and Boskop skulls.

I think it highly probable that the frontal region in the "Bushmanoid" group has evolved very much as Dreyer suggests, even if his phylogenetic inferences are not necessarily acceptable. But I suspect that the starting point of this sequence was a type less extreme in development than the Florisbad skull, and possibly not very different in frontal characters from the Singa skull.

It would be a happy conclusion if we could regard the Singa skull and M.R.1 as within the range of variation of a single proto-Bushman type, but the difference in frontal and parietal breadth appears too great for this. Nevertheless I consider the Singa fossil to be at least as nearly related to M.R.1 as to the Boskop skull. The solution which again offers itself is that in these skulls we have a common proto-Bushman stock modified either by divergent descent or by hybridization. Which of them most nearly preserves the basic features of this stock can only be determined when we have available series instead of individual skulls.

In view of the distance separating them, it would have been most remarkable had the Singa fossil proved to be exactly comparable with any individual specimen from South Africa such as M.R.1 or the Boskop skull. The fact that it falls naturally into this constellation of "Bushmanoid" types is sufficiently significant.

Relation of the Singa Skull to North and East African Types

Smith Woodward qualified his assertion that the Singa specimen "differs from all human skulls hitherto described as found fossil in North Africa" by remarking that "it seems to resemble a little some skulls in the varied collection made by Dr. C. Arambourg from an Upper Palaeolithic deposit in the rock-shelter of Afalou-bou-Rhummel on the coast of the Gulf of Bougie in Northern Algeria". He appears to have had in mind particularly those skulls which Arambourg, Boule, Vallois & Verneau (1934) have characterized as "type à tendance brachycephale". I consider, however, that if the Singa fossil is compared with the excellent illustrations published by these authors, it must be deemed fundamentally different. This is perhaps most evident in the supraorbital and interorbital regions, but it is also true of the temporal region and hinder part of the braincase. It appears very unlikely that there is even a trace of the Singa type infused into the Afalou group. The differences which set off the Singa skull from those of Afalou also distinguish it from all European crania of Upper Palaeolithic as well as more recent age.

It might also be imagined from the broad frontal region and thick prominent supra-orbital region of the Singa skull that it might be compared with the Skhul group of Neanderthaloid fossils from Palestine. Had the Singa frontal bone been found isolated, it seems possible that an attempt might have been made to force it into this group. But the detailed analysis of the Skhul frontal region made by McCown & Keith (1939) clearly differentiates the Singa specimen from it, apart from equally marked differences in the hinder part of the braincase.

South of the Sudan, a large number of fossil skulls from Kenya have been described by Leakey (1935). None of these reveals a combination of features at all approaching that of the Singa skull, especially with regard to its frontal characters. Nevertheless the skull Gamble's Cave 4 of Kenya "Aurignacian" age, although longer and narrower than the Singa fossil and totally different in its frontal and interorbital regions, resembles it in displaying well-marked parietal eminences, a similar occipital profile, and small mastoid processes. The same features may be identified in other skulls from Kenya of more recent age. Leakey has indeed characterized the Mesolithic skulls from the Homa shell-mounds as "Boskopoid", and this might equally be applied in a loose sense to other crania of Mesolithic and Neolithic age. Thus although these pre-historic types of Kenya are all basically "Caucasoid", it seems possible that there is an element in them related to the Singa type.

This suggests a further tentative speculation. The industry with which the Singa skull is associated appears to belong to the Levalloisian tradition. Now Leakey has maintained that in Kenya the Levalloisian and its derivative the Kenya Stillbay represent a sequence developing parallel to but independently of the Kenya "Aurignacian". In South Africa the Matjes River and Boskop crania as well as that of Springbok Flats are associated with industries of the same Levalloisian tradition. It seems at least possible that the same "pre-Bushman" stock was associated with the Levalloisian and its derivatives in north East Africa, and mingled to a small extent with the contemporary Aurignacians.

The only human type which has so far been associated with the Levalloisian in East Africa is the Lake Eyasi (Njarasa) fossil skull. This has been variously ascribed to a very primitive (Pithecanthropic) type, and to a type closely resembling and perhaps identical with the Broken Hill skull (*Homo rhodesiensis*). After examining casts of the Lake Eyasi material, I consider that it is definitely not Pithecanthropic. While the possibility that it is related to Rhodesian Man is much stronger, there seems to be still a further alternative, viz. that it is to be compared with "pre-Bushman" types. It cannot be directly related to the Singa skull, for the hinder portion, which is the best preserved part of the Lake Eyasi fossil, is much narrower and has a very different transverse contour. In these respects the Lake Eyasi skull rather suggests comparison with the Fish Hoek and Cape Flats crania from South Africa, but its frontal region appears very much more primitive than that of either of these specimens. The remains of this region are, however, very fragmentary, and it seems quite possible that it should be reconstructed rather similarly to that of the Singa skull, or if not so to that of the Florisbad skull. Until the conformation of the zygomatic region is known, I find it impossible to determine whether the Lake Eyasi skull is "Rhodesioid" or "Bushmanoid" in type. It seems to me, therefore, that the Levalloisian associations of the Lake Eyasi skull are not at all incompatible with similar associations for the Singa skull.

Another African fossil which demands comparison with the Singa skull is that from Asselar in the southern Sahara, described by Boule & Vallois (1932). These authors interpret the Asselar skull as "Hottentot" in type, and also remark on its resemblances to the Boskop fossil. It remains doubtful, therefore, whether this skull is fundamentally "Bushmanoid" or whether it is related to non-Bushman elements which have penetrated into South Africa and there mingled with the Bushmanoid types. In any case the Asselar skull differs from the Singa fossil in being longer, narrower and lacking the supraorbital prominence. Even if it is fundamentally Bushmanoid, it represents a variation of this type quite separate from the Singa specimen.

Finally, the recognition of a "pre-Bushman" type in the Nile valley raises the issue of the centre of origin and direction of spread of this type. Here we have at present two opposite points of view. Most South African workers have regarded the "Bushmanoid" stock as native to Africa and especially to southern Africa, whence it overflowed into North Africa; Dart (1939) has even suggested that it penetrated into Europe. Broom (1941) in South Africa supports the contrary view, favoured by several thoughtful investigators outside Africa, that the "Bushmanoid" type entered Africa from the north and has an ultimate Asiatic origin. If it could be demonstrated that the Singa skull is older than the earliest Bushmanoid crania of South Africa, it might be interpreted as evidence for the latter view. But if we accept the frontal characters of the Singa skull as those of an early stage in the specialization of the Bushman type, it might equally be argued that it represents an early northward expansion from a southern centre of origin. Until we are more certain of the relative antiquity of such South African finds as the Boskop skull and M.R.1, as well as of the Singa fossil, any hypothesis of the mutual relationship of these types which goes beyond recognizing that they are all "pre-Bushman" must remain speculative.

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THE STONE INDUSTRY OF SINGA—ABU HUGAR

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The artifacts collected at Abu Hugar by Mr. A. J. Arkell may be considered as the industry of the Singa deposit, in view of their geological setting.* True implements and improvised tools occur. Fairly heavy, simple core-tools, flakes, and utilized cores represent the first, hammerstones and pounders the second. Most are composed of poor and refractory materials, the study of whose response to treatment as evidenced by scars, is highly instructive.

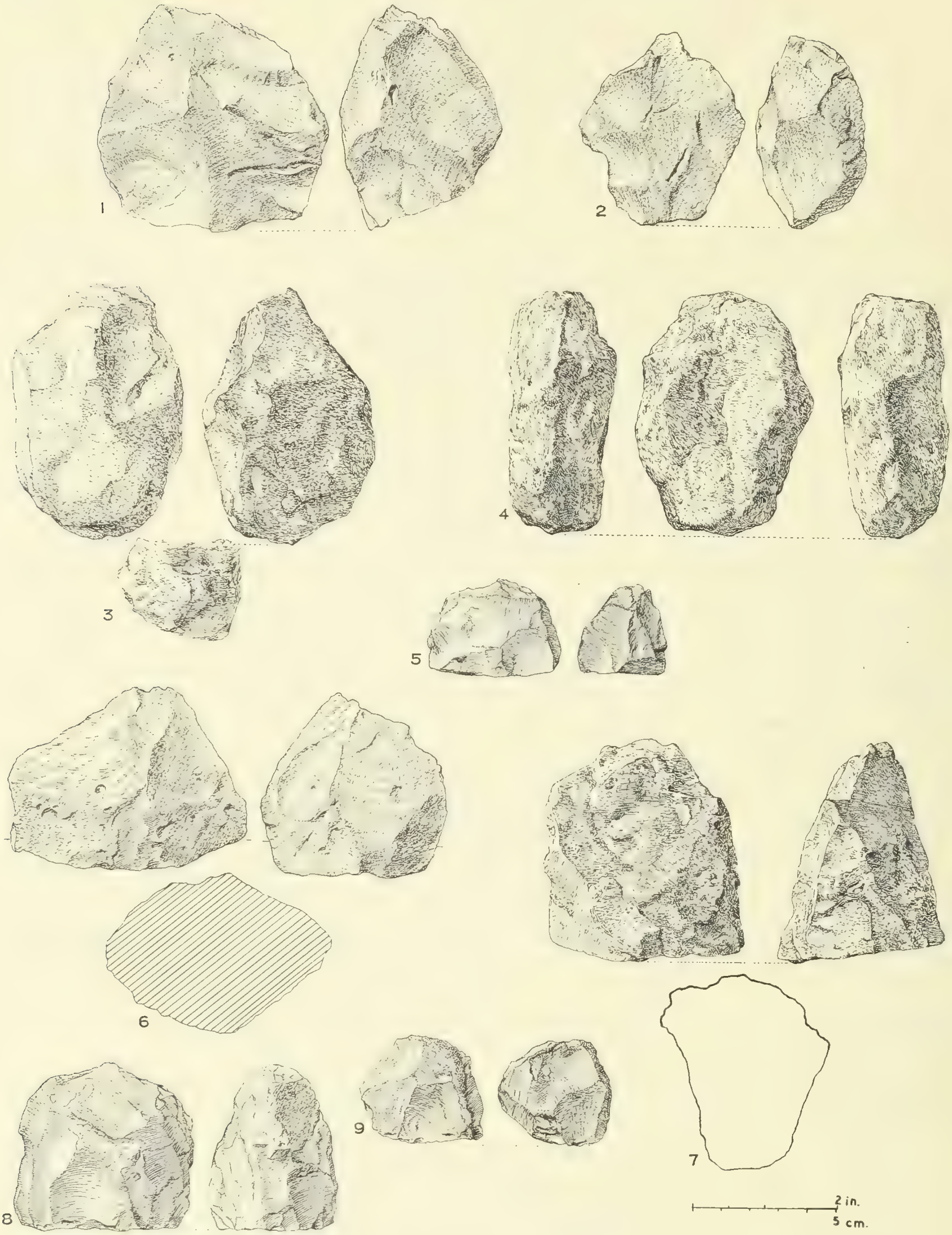
While, then, the collection at first sight looks crude, yet inspection shows that its ingredients are the relics of knappers well versed in flaking techniques. For, from pieces of intractable stone they produced several quite definite forms. These help us to assess the series. Representative and particularly remarkable specimens are figured here. They may be said to belong to a moderately heavy equipment lacking fine flakes. This characteristic is undoubtedly due to the nature of the raw material.

Core-tools.—These consist mostly of cobbles and lumps brought to an edge by bold flaking, hammerstones having certainly been used in this process. Although some of these products of the industry may have served as hand-axes, yet on typological standards none can be so described. Rather are such objects to be regarded as choppers of the elementary kind made by man throughout the whole course of his stone-using development.

From the wear apparent on part of its sharp middle edge, the artifact, No. 1 (silcrete sandstone) which is not unlike a Levalloisian core, seems to have been put to some forcible use. Bruises on the untreated surface (not seen in drawing) suggest that the tool also served in conjunction with a hammer. A smaller version of this implement is represented by No. 2, flaked in the same material. It exhibits no signs of wear; but pronounced abrasions at one end of a profusely flaked cobble of vein-quartz, No. 3, point to considerable use. This specimen, fitting comfortably into the clasped hand, is furnished with sharp edges. One, long and sinuous, intersects another, short and irregular, at the end opposite the somewhat injured butt. Since the ridges on one flaked surface under the rounded back are dulled, it is probable that the tool served both as a heavy scraper and as a cutting instrument.

It is likely that No. 4 was employed as a two-edged side-scraper rather than as a chopper. Better perhaps than any of its companions, this implement demonstrates by the character of its treatment the local shortage of tractable raw material. It consists of a lump of reddish stone, probably a ferruginous and silicified sandstone, from which a few chips were detached from the sides of both faces. How indocile the stone proved under blows appears from the irregular and shallow scars.

* *See* Arkell, A. J. 1949. The Old Stone Age in the Anglo-Egyptian Sudan. *Sudan Antiquities Serv. Occ. Papers*, **1:** 45–47.



FIGS. 1-9. Stone artifacts from Abu Hugar. Descriptions are given in the text (pp. 43, 45).

More positive forms of heavy scrapers are present. The commonest are steep core-types, some recalling the rare "tea-cosy" shape of European Acheulian industry, others more definitely the European Upper Palaeolithic core-scraper of sloping finely flaked faces. In this industry from the valley of the Blue Nile, it seems that little of the material was worked for the purpose of obtaining flakes or flake-blades, for its poor quality hardly allowed the production of more than core-scrapers. This is indicated not only by the edges of the artifacts but also by the size of the scars. These prove that the flakes removed would have been too small for use by people whose kit cannot be shown to include any really delicate tools. No. 5 (vein-quartz) and No. 6 (pebbly silcrete sandstone) are illustrated as characteristic of the "tea-cosy" sort, and No. 7 (a poor vein-quartz) of the more advanced type. In the first of these tools, the upper edge, which results from the flaking of the lump, is bruised from use; in the others it retains its pristine sharpness. The shape of the working-edge of No. 7 can be appreciated only by a glance at the outline of the base, which accompanies the drawings of the implement.

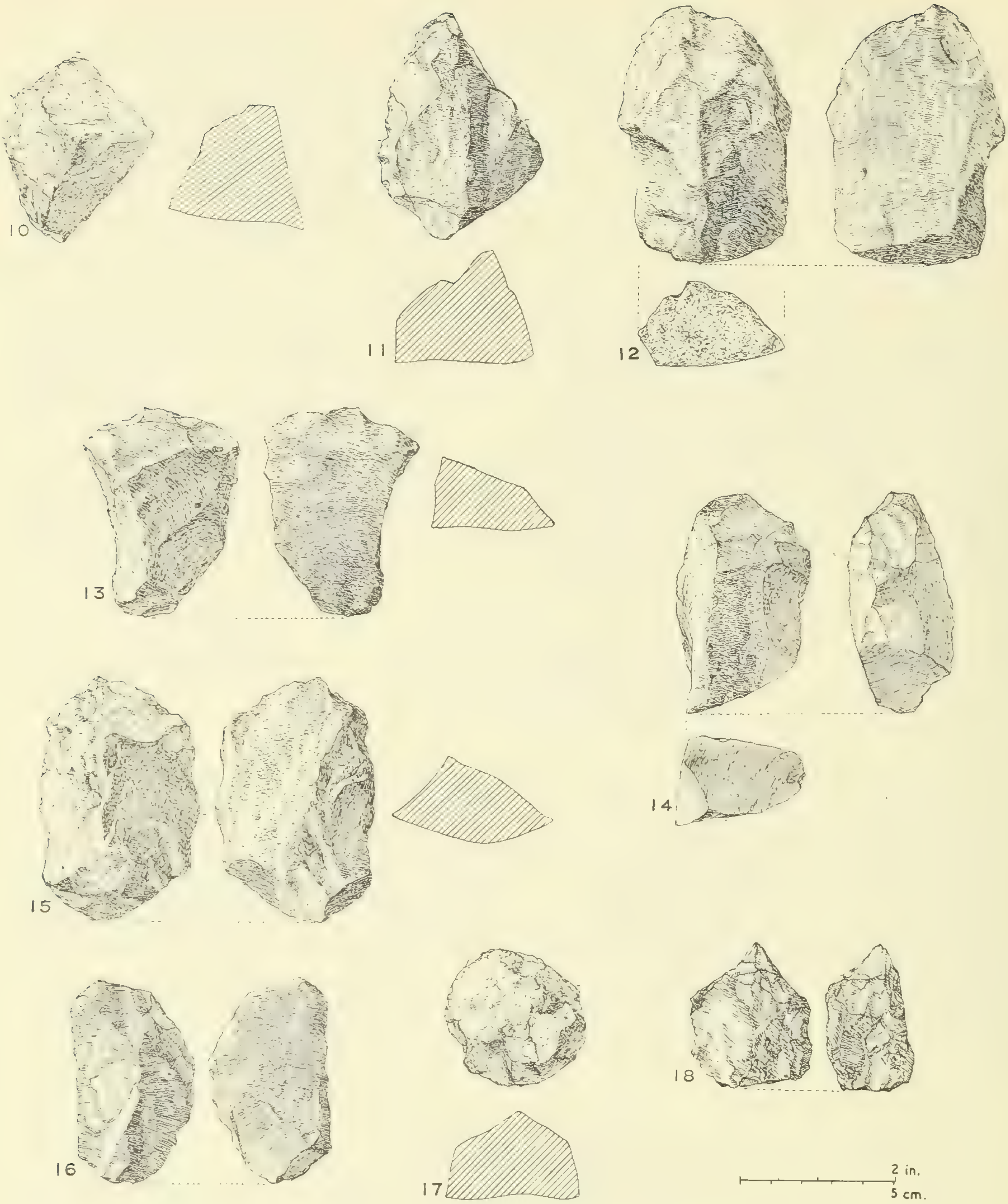
No. 8 (vein-quartz), finely and symmetrically flaked from the base in quite advanced style, may have been intended as a scraper. Its circumference, however, exhibits no signs of wear, unlike its apical edge formed by the intersection of the scars. It is conceivable, therefore, that this artifact was used as a sort of chisel or axe, and was fitted into a holder, such as a large bone or piece of wood. In No. 9, of finer material and much smaller, we have a tool which may be referred to the same category.

A few small discoidal cores flaked to a sharp, sinuous circumferential edge, and some walnut-sized stones, irregularly scarred and slightly bruised, may possibly have been used in slings. Except for these objects, the assemblage includes nothing which can be considered a weapon.

Flake-tools.—These comprise implements made on pieces or slices of stone and on true flakes. Scrapers are common and come under ordinary headings.

1. Several well-defined side-scrapers are present. Two are figured as characteristic of the industry, namely Nos. 10 and 11. Both are carefully made in pieces of stone, the height of which alone would make these two specimens worthy of notice. In these the signs of workmanship contrast, and reflect in an interesting manner the difference in the tractability of the materials. The curved edge of the smaller, No. 10 (quartzite) has been achieved by the steep removal of a few short flakes. In the second and larger, No. 11 (a fine brown silcrete sandstone), the manufacturer found it possible to detach a close succession of squills by percussion, so producing an edge much superior to that of the companion implements.

2. True end-scrapers are present, and show certain features of interest. Thus, the heavy example, No. 12 (brown cemented sandstone) comprises a thick flake with wide inclined striking-platform. Naturally rounded opposite the butt, the end has been treated by short flaking for a little way on the sloping face and curved margin of the nether surface. Another specimen, No. 13 (also of brown cemented sandstone), though now defective in its lower part, is remarkably well made. Fashioned from a flake, which was removed from a prepared core—to judge from the ridges and scars—its working-end exhibits signs of treatment on both faces, as do the end and right side, but only on its upper surface.



FIGS. 10–18. Stone artifacts from Abu Hugar. Descriptions are given in the text (pp. 45, 47).

3. Combinations of the side- and end-scraper are represented. In the two specimens figured, the working-edges have been made by removing small flakes from the upper surface at the end, and on the nether surface along a margin. No. 14 (a coarser cemented sandstone) consists of a large piece struck from a lump, the detaching blow having been powerful enough to cleave quartz and other inclusions. Only one of its long edges has been trimmed. On one side the end is bruised by hammering. No. 15 (close-grained pebbly brown silcrete sandstone), besides being dressed at the end on the face, has been trimmed along both long margins on the reverse. A finer tool is represented by No. 16 which is made on a quartz flake. As the scars and ridges on its upper surface proclaim, this was removed from a prepared core. Moreover, the long convex edge has been as carefully treated as the material allowed by the removal of flat squills from the nether surface. The end seems to have been put to considerable use. Below the point of impact on the narrow striking-platform there occurs a clear but narrow swelling or ridge of percussion.

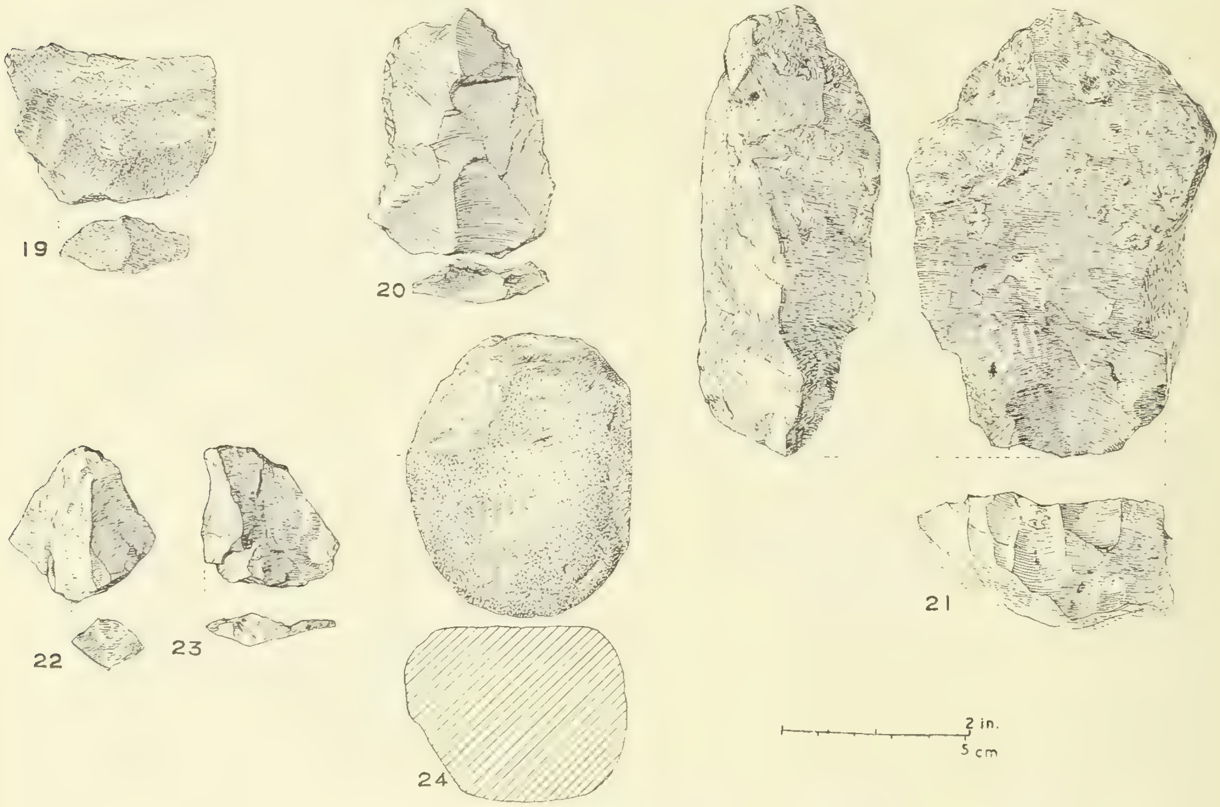
4. A steep round scraper of vein-quartz, No. 17, made from a sliced pebble, is illustrated as exceptional. It is particularly well manufactured, but owing to the poor quality of the stone, the edge of the tool, which extends all round, has not been produced by retouch, but by bold flaking. This working has involved almost the whole of the surface, the nether one exhibiting the negatives or hollows of percussion. These show where small trimmings were detached. In its typology this specimen would appear to mark a distinct advance on the general run of implements in the group.

5. A curious and yet efficient perforator is shown by the drawing of No. 18. Basically the implement consists of a thick portion of a split quartzose pebble, its point executed by the removal of material on each of the steep sides of the median ridge. The trimming on the right is more pronounced than on the left, and extends for the whole length of that side. It is interesting to observe that the edges of the retouched hollows on either side of the point could have served for scraping.

6. Two veritable knives stand out, one, No. 19, made from a thick vein-quartz flake, the other, No. 20, from a blade of green lava-type rock (aphanite). The first consists of a piece struck from prepared material. Its principal separation surface displays a marked swelling of percussion, not unlike the bulb in better stone. The long cutting-edge results from the removal of a long narrow flake from the end opposite the butt. On this there appear two pronounced facets. They are, however, not truncated scars such as would result from the detaching of a parent flake from a treated core, for they originate from blows applied to the platform after the piece was detached from the lump. Finer trimming appears also for a little way on the right side of the butt. All these traces show that the lower end was treated to reduce unwanted roughnesses. So dressed, the implement could also have been used as a butt-end scraper of the type which first occurs in the Middle Acheulian of western Europe, and which later is so characteristic of Levalloisian industry. The second tool is even more interesting. Like its companion, it has been struck from well-prepared material, certainly a core. This, to judge from the character of the scars, would assuredly be of the type which, usually regarded as Levalloisian, had its beginnings in well-developed Middle Acheulian industries. Hence the butt of this artifact exhibits typical truncated flake-scars from the preparation of the striking-platform,

and the upper surface those resulting from the blocking-out of the parent lump. The most notable feature, however, consists of fine retouches along the two lateral margins, slightly convex on the right and almost straight on the left.

7. Although there are several flakes struck like No. 20 from material prepared in characteristic Levalloisian manner, yet unfortunately only one core, No. 21, is present to exemplify this method of obtaining large flat flakes. Consisting of a block of quartzite, from which but few pieces have been removed, the specimen deserves notice for the very simplicity of its scarring. A side and end have been flaked, and from the platform so treated a large, wide flake was struck. But, as is attested by a



FIGS. 19–24. Stone artifacts from Abu Hugar and Singa. Descriptions are given in the text (pp. 47, 48).

ridge a short distance from the hollow of percussion, the stone proved too refractory for further attention. Despite this, on the ground of technology the identity of the example with a true "tortoise-core" is obvious. Small flakes which came off in the preparation of such cores are represented by Nos. 22 and 23 (respectively of brown silcrete sandstone and vein-quartz).

Improvised tools.—The collection is not comprehensive enough to permit one to assert that the anvil technique, or flaking and shaping on a fixed block, was practised in the industry of Singa and Abu Hugar. It is clear, however, that hammerstones were used. The specimen, a cobble of fine-grained pink aplitic rock, figured as No. 24, deserves more attention than is usually paid to such improvised tools. This one exhibits all the convincing abrasions of the purposes and the methods to which it was put. Thus, an end is boldly scarred from its having been used to detach fairly large flakes in rocks at least as refractory as that of which it is composed; and the other is finely pitted from treating hard but more tractable material. One of its flatter surfaces is also dented as if the stone had served as a small anvil; and one bruised area suggests that the tool was used to tap a smaller stone. This object has a smaller companion of quartz which, if it does not reveal so much, yet shows by its freely scarred and abraded surface that it was long employed in flaking. Another, a spherical implement of silcrete, belongs to the same category of accommodation-tool. It is, however, worn differently from the others in this list. The abraded surface, forming a complete zone of wear, indicates that the stone served as a pounder. That it was used to crush pigments is immediately suggested by the lumps of red ochre which Mr. Arkell has found in association with the artifacts at Abu Hugar.

Cultural affinities.—This industry owes its archaic aspect to the low grade of practically all the materials used. At first sight this is enhanced by what seems to be crude workmanship. Actually, however, apart from the signs of wear on the edges of some of the tools, the surfaces show no traces of injury such as might result from carriage in stone-charged deposits. Most indeed are in the same fresh condition as when they left their manufacturers' or users' hands. These points argue for their occurrence *in situ* in the containing beds, and indicate that the industry should not be assigned to a culture of relatively great antiquity in the African Palaeolithic sequence. To the contributor of these notes, the series demonstrates that what looks very ancient may not in fact be so. This is upheld by the absence of hand-axes, and by the presence in the assemblage of well-defined forms such as nowhere occur as products of the older Palaeolithic industries. In the writer's opinion the most decisive specimens are the high core-scrapers, small and large, and the short edge-retouched, flat blade-like flake of developed Levalloisian facies, No. 20. Even without the support of other tools, such as fine flake-blades and gravers (*burins*), the example No. 7 resembling an Upper Palaeolithic blade-core would alone herald the break with old traditions, and indicate well-advanced African Middle Stone Age workmanship. This would assuredly be much more apparent were the artifacts fashioned in finer materials, chalcedony, jasper, silicified wood, or even high-grade quartz.

Notwithstanding the foregoing, flakes with faceted butts and specialized cores are numerous enough to demonstrate that the Singa–Abu Hugar industry has affinities with those in which Levalloisian stone technique is dominant. These links must therefore be sought in a complex later than one embracing the industries of the hand-axe group. On typology, and in view of what is now known of the Stone Age cultures of Africa, it appears to the writer that the closest parallels to the Singa–Abu Hugar facies is provided by the advanced Levalloisian or Proto–Still Bay industry of Lochard, South Rhodesia.* The output of the Lochard industry does not, however, include such culturally advanced forms as the high cores and core-tools described and figured here, which particularly mark this collection. Hence it is believed that this industry

* Neville Jones, *The Prehistory of Southern Rhodesia*, Museum Memoir No. 2 (published for the Trustees of the National Museum of Southern Rhodesia), Cambridge, 1949, pp. 34–36.

may correspond in date to one more developed than that of Rhodesia, with which comparison has been made. Future research must be left to decide whether there is an extension of the Still Bay complex as far north as the Blue Nile. Great interest and importance, however, must always attach to this, the earliest industry so far discovered in the Sudan in association with extinct animals and with a human skull.

Thanks are due to Mr. G. Andrew for having kindly identified the rocks used in the industry of Singa and Abu Hugar; and tribute is given to Messrs. C. O. Waterhouse and C. H. Stokes for their skilful drawings of representative specimens.

The collection of stone implements on which this report is based comprises fifty-one specimens. Thirty-five of these are preserved in the Khartoum Archaeological Museum. Through the courtesy of the Sudan Government Museums Board the remainder (including those shown in figures 2, 3, 6–8, 10, 13, 15, 17–20, 22, 24) have been deposited in the Department of Geology, British Museum (Natural History): registered numbers: E.1463–1476, figured in the above order; E.1477, E.1478 unfigured.

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